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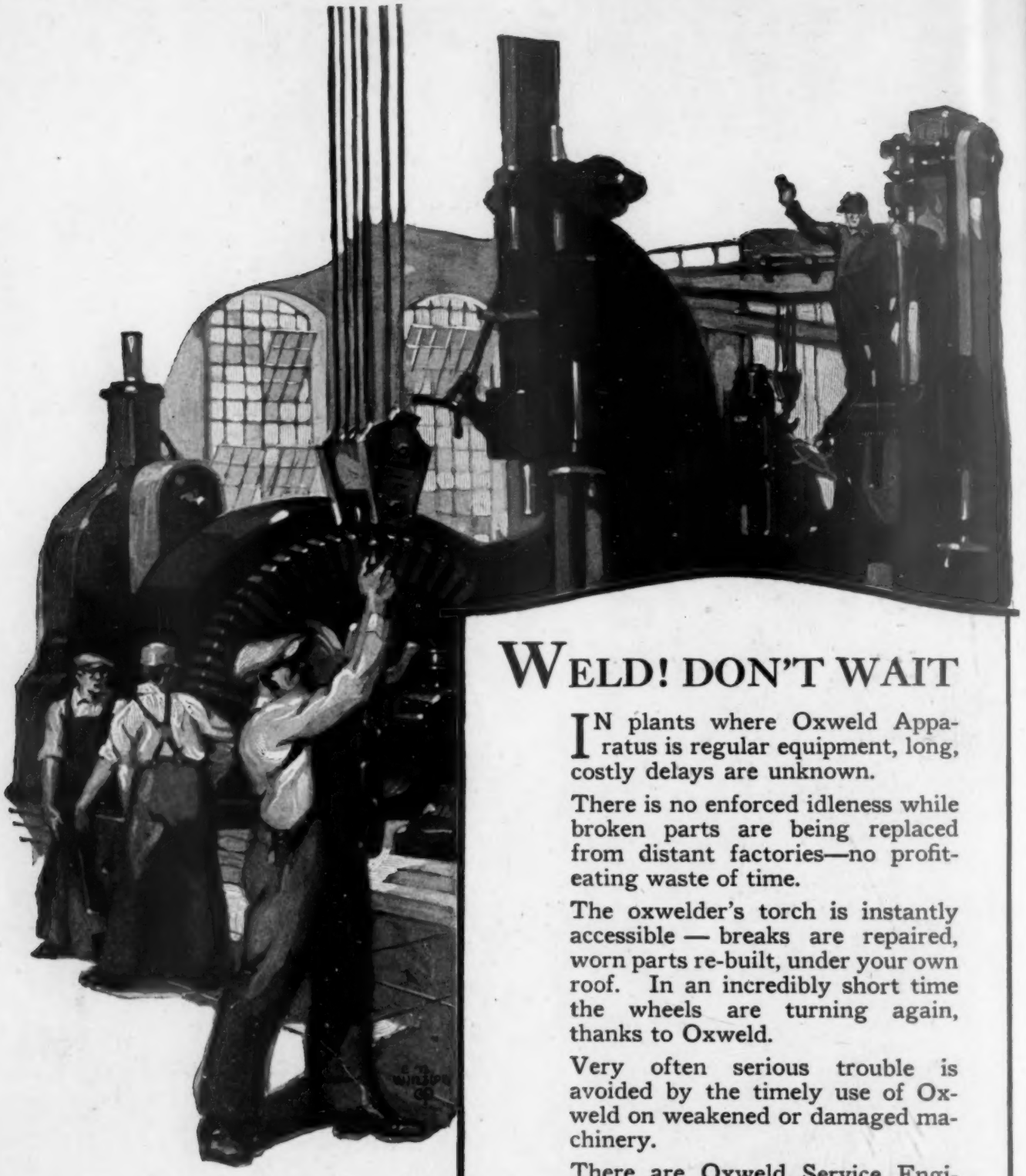

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Commercial Acetylene Supply Co.
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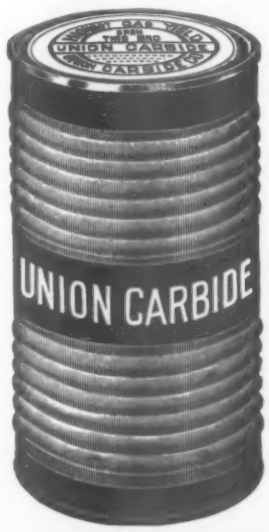

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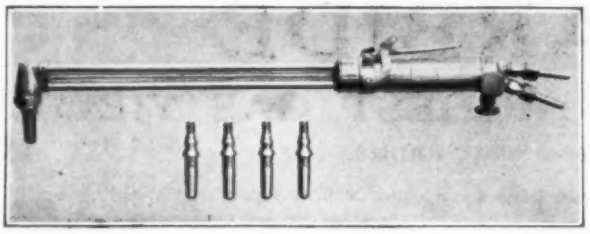

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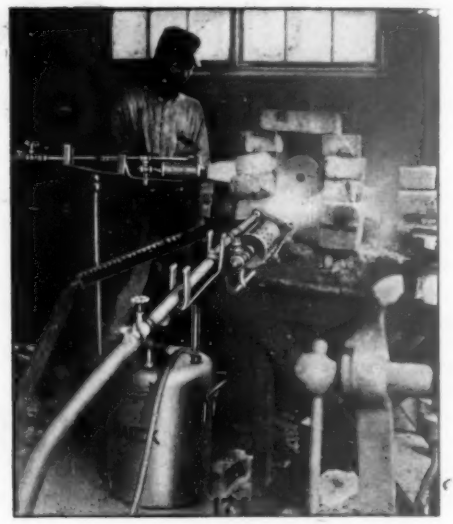

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Most efficient generator for producing Oxygen and Hydrogen

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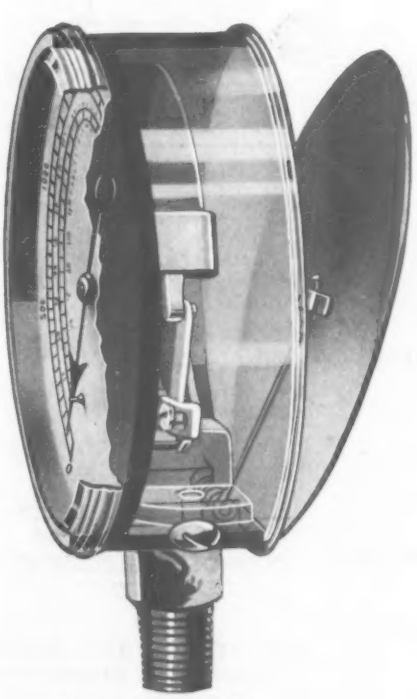

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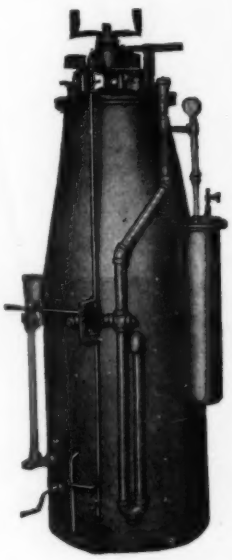

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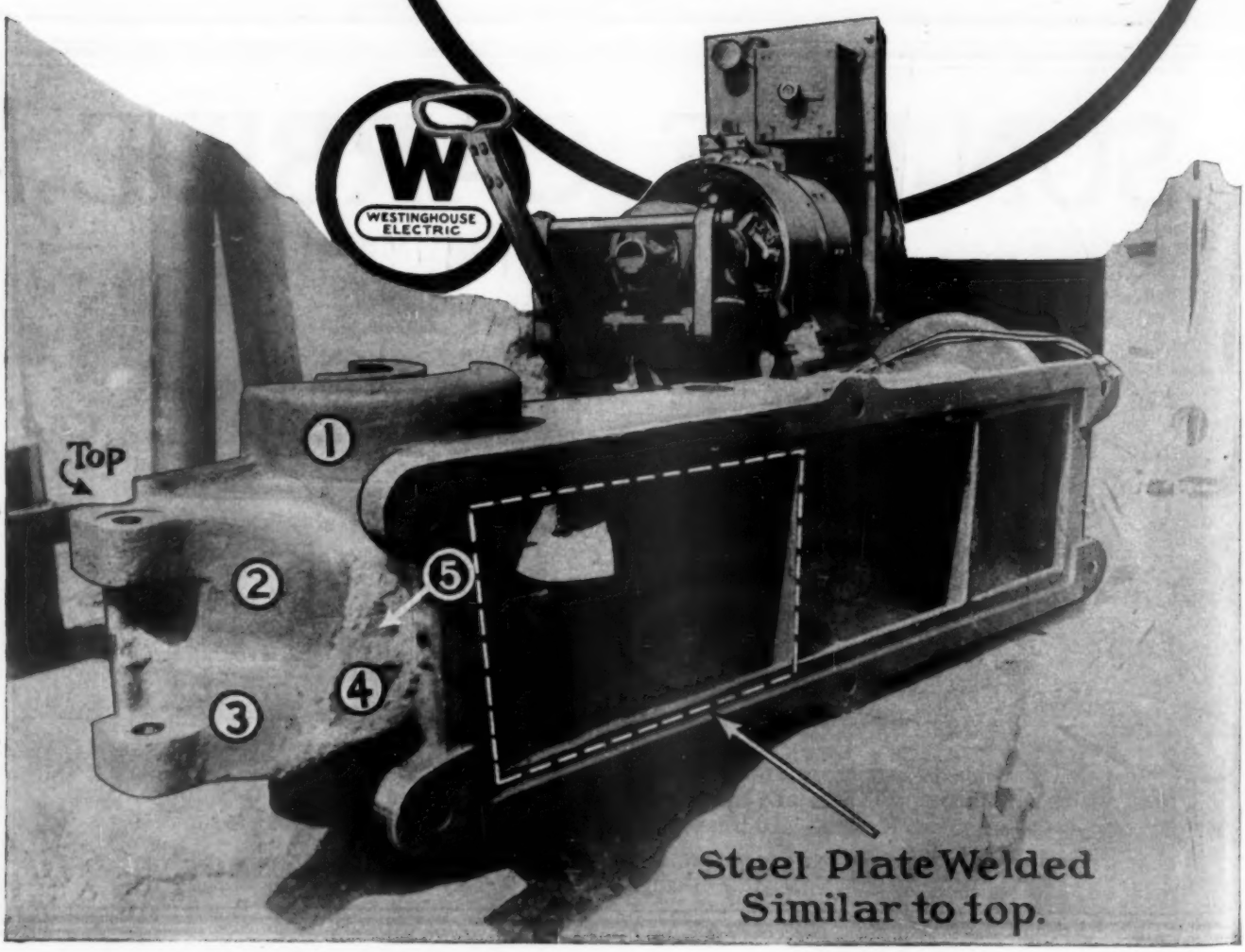

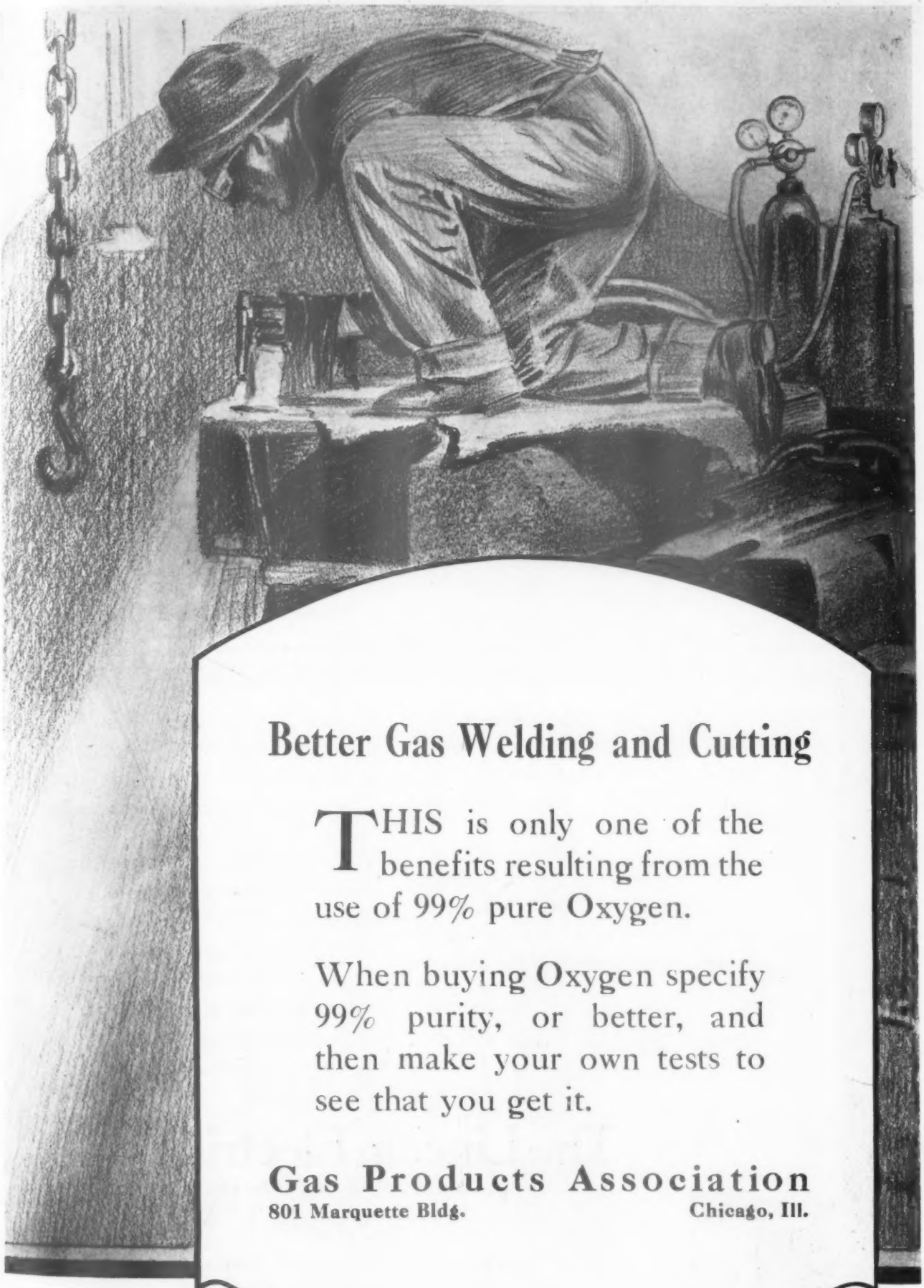

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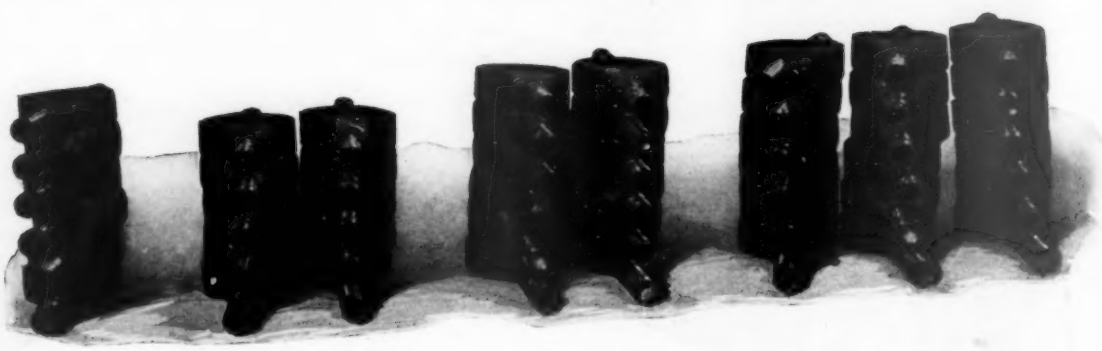

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Multiple Operator Outfit	Rating 200 Amperes	Rating 150 Amperes	Rating 200 Amperes
No rating given	(½ hour intermittent)	(Continuous welding duty)	(Continuous welding duty)

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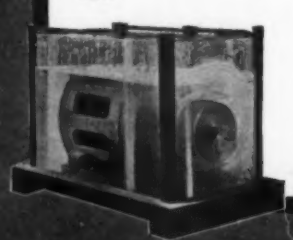

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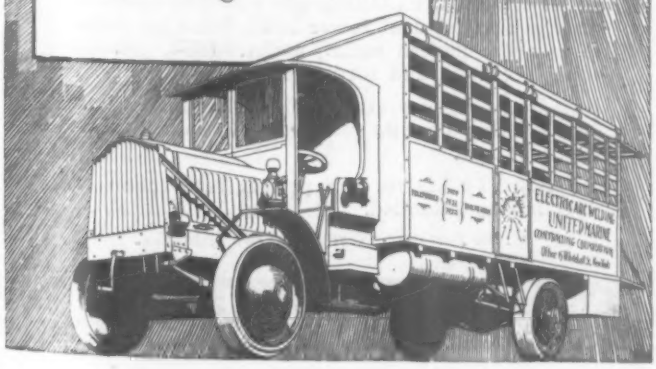

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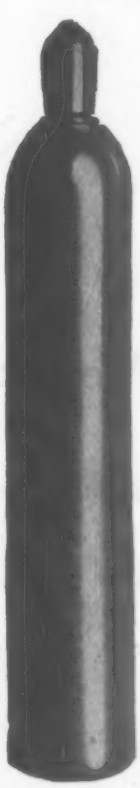

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Principle of Carbon Burning—Method of Operation—Lead Burning—Soldering—Case Hardening—Heating Uses.

CHAPTER VIII.—HOW TO FIGURE COST OF WELDING.
Oxygen Consumption—Dissolved Acetylene Consumption—Torch Consumption Test—Acetylene Generator Consumption—Cost Card—Conclusion.

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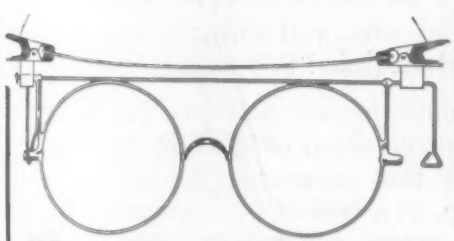

The Histed Novelty Goggle

FOR WELDERS

is attached to the welder's cap by means of two little spring clips that clamp to the visor of the cap and hangs clear of the face, thus avoiding the possibility of the face or nose being blistered by the hot metal touching the skin. The lenses are 2 inches in diameter, which gives ample eye protection and prevents the welder looking past the lens when welding overhead. Good ventilation is assured by the Goggle not being enclosed and admitting plenty of light, thus keeping the eyesight normal at all times—that is, not dilated as in enclosed Goggles. No moisture from perspiration can gather on lenses, thus keeping vision clear, adding materially to the welder's efficiency. When inspecting work, the Goggle may be swung to a raised position and back quickly, without loss of time at welding, or removing gloves, or laying down torch or welding rod—a great advantage over those using the elastic head-band or ear-bows. When Goggles are not in use they are swung to a raised position and held in place by spring, and may be worn on cap visor at all times without inconvenience. They are always ready and stay nicely in place, whether welding down or overhead.

Patent Allowed—April 3, 1919.

The Goggles are supplied with the "Wilson Industro Lenses" in any degree of density desired. Practical welders can't speak too highly of the

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The Name is Your Guarantee

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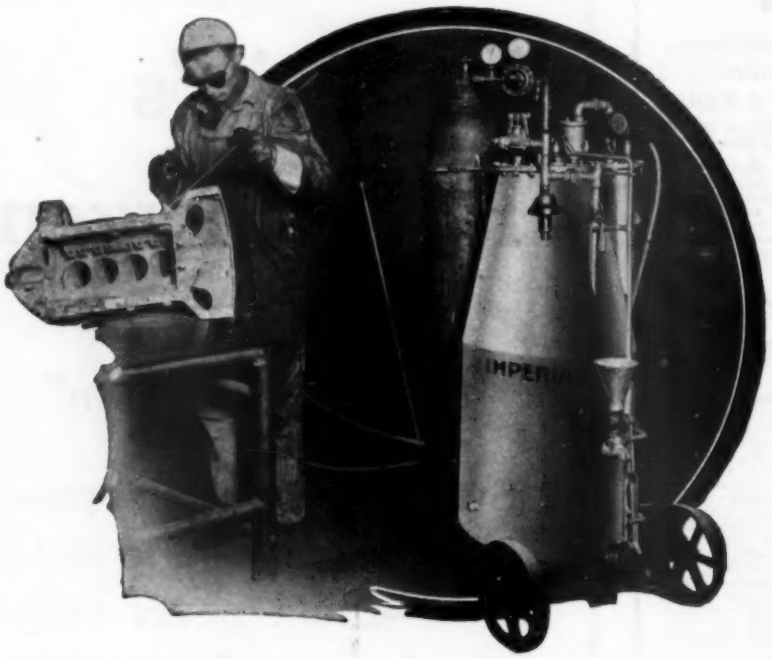

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Details of the Milburn Suit in Federal Court

ON December 30th, 1920, the Alexander Milburn Company filed suit to recover $2,250,000 damages for alleged violations of the Sherman and Clayton Anti-Trust acts and the Federal Trade Commission act and for alleged unfair methods of competition, against the Union Carbide and Carbon Corporation, of New York, and subsidiary companies:

THE UNION CARBIDE COMPANY
THE UNION CARBIDE SALES COMPANY
OXWELD ACETYLENE COMPANY
LINDE AIR PRODUCTS COMPANY
PREST-O-LITE COMPANY, INC.,
and THE DAVIS-BOURNONVILLE COMPANY

The declaration in the action against the Union Carbide and Carbon Corporation alleges that the concern and its subsidiaries entered into unlawful combinations and conspiracies to eliminate competition and monopolize the industry controlling the manufacture and sale of carbide, oxygen gas, acetylene gas, acetylene generators and apparatus used in the welding and cutting industry. It is also alleged that the concern elected and retained interlocking boards of directors in violation of the anti-trust laws.

The declaration also charges that the conduct of the business of the concern and its subsidiaries is contrary to the common and statute laws, creates a monopoly, unfair methods of competition, directed alike against the public and other manufacturers and dealers in the same line of business.

The declaration charges that the corporation and its subsidiaries or associates, the defendant companies, committed the following acts:

1—Repeated, published and circulated false reports that the Milburn Company would not be able to perform its contracts or properly care for its customers.

2—Made false representations that Milburn apparatus and machinery infringed patents controlled by the corporation or its subsidiaries and threatened to file and did file suits.

3—Demanded and required of the Milburn Company and other manufacturers and dealers the names of their customers, dates of all sales, list of apparatus supplied their customers, dates of shipment and other information before the corporation and its subsidiaries would furnish such users of apparatus with oxygen and acetylene or pay dealers the jobbers commissions thereon.

4—Agreed and conspired to divert and control all sales of Oxy-acetylene and other similar apparatus and appliances to railroad companies so that such business should be handled and controlled by the subsidiaries of the corporation.

5—Agreed and conspired to divert and control the sale of equipment to the army and navy, so that such business should be controlled by one of the defendant companies. That in order to facilitate such control the defendants conspired to secure appointment of their employees by purchasing bureaus of the United States Government.

6—That the corporation and its subsidiaries committed acts against the Milburn Company for the purpose of discrediting it and damaging its reputation for efficiency of its apparatus.

7—That the corporation conspired and contrived to dissuade agents, representatives and employees of the Milburn Company from continuing to act in such employment.

8—That the corporation conspired to control other trade organizations, to obtain modifications of the rules and regulations of the National Board of Fire Underwriters and the Wisconsin Industrial Commission, and to bring about changes in the specifications of the Army and Navy for the use of various gases and apparatus and to use such organizations and associations to discredit Milburn apparatus and equipment.

9—That the corporation conspired to influence the Underwriters' Laboratories to establish rules and regulations injurious to the Milburn Company and to cause delays in the tests of and reports on its apparatus and equipment.

At the same time suit was filed asking $250,000 damages against the Underwriters' Laboratories, Incorporated, of Chicago, alleging damages for failure of the Laboratories to make fair, prompt and accurate reports upon apparatus submitted, with malicious intent to injure the Milburn Company, also preventing the introduction and sale of Milburn apparatus by causing unfair and unreasonable delays in making tests and reports and making them in such a manner as to interfere with the operations of its apparatus.

The declaration further states that the Underwriters' Laboratories discriminated against the Alexander Milburn Company by requiring it to incorporate in its devices certain features not required by other apparatus manufacturers.

Paid advertisement of The Alexander Milburn Company, Baltimore, Md.

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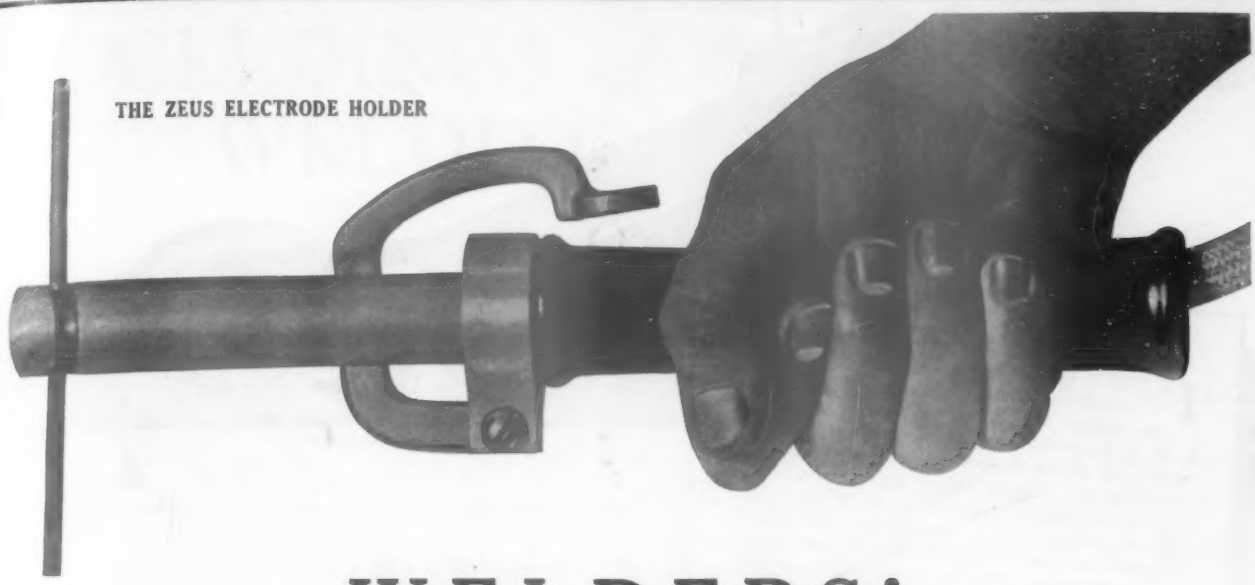

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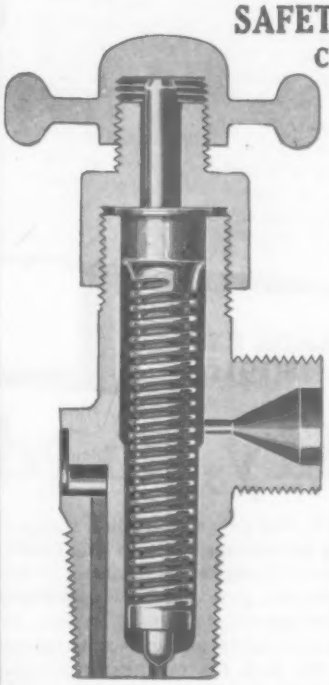

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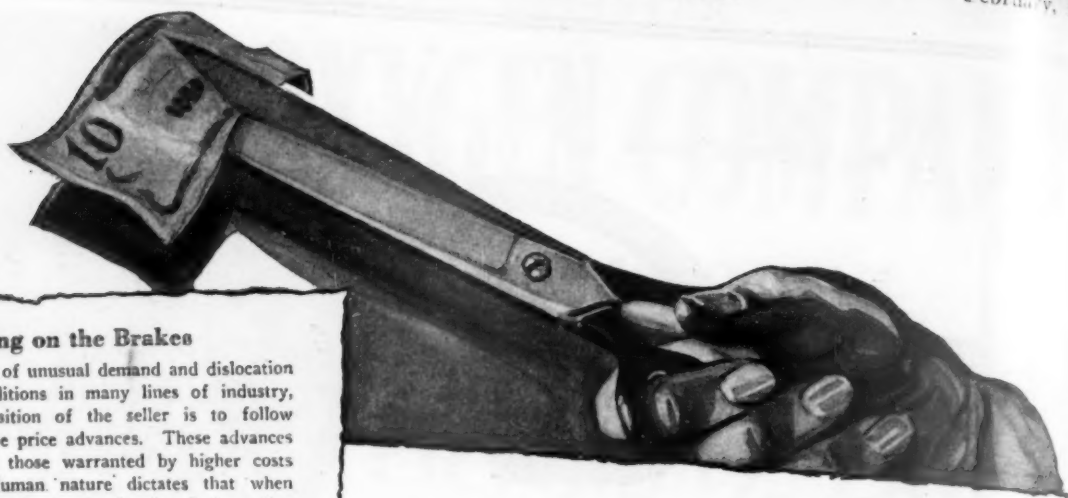
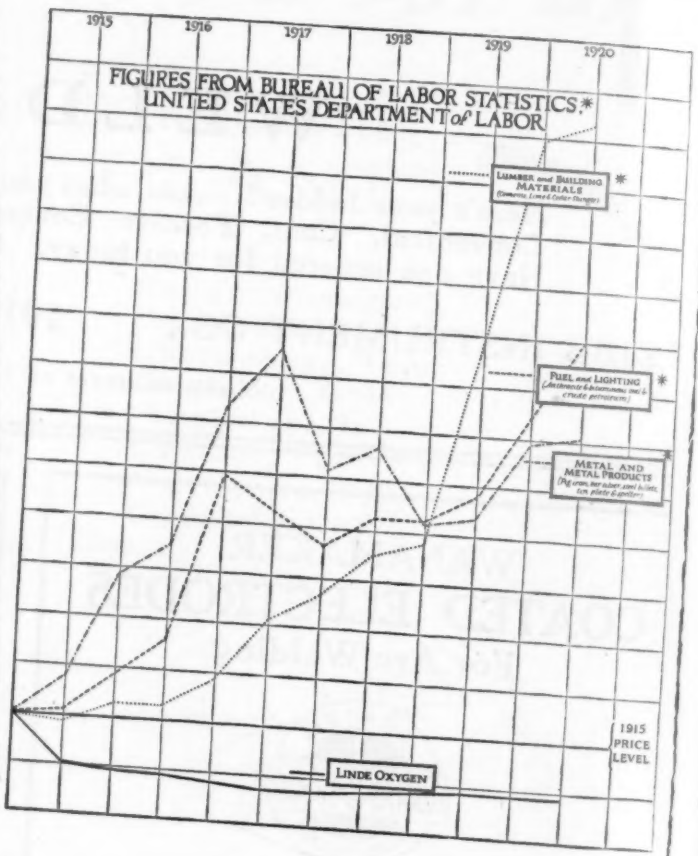


Putting on the Brakes

IN THESE days of unusual demand and dislocation of normal conditions in many lines of industry, the natural position of the seller is to follow a line of progressive price advances. These advances usually far exceed those warranted by higher costs of production. Human nature dictates that when a market is completely in the hands of the seller, as it is in many raw or manufactured materials at the present time, the obvious course is the most advantageous one, namely, that the price should be all that the traffic can bear.

Sound business policy frequently runs counter to natural impulses. Understrained price advances, no matter if the continuing demand appear to be so strong as to justify them, eventually reach the point where they shut off buying for the reason that the ultimate consumer cannot stand the cost. There is a maximum point beyond which to advance prices is to impose an undue burden upon one party and to threaten the good of the whole trade, since, after all, the best interests of buyers and sellers are interdependent. Large steelmakers are giving due recognition to this truth by throwing their influence against any further general advances in their lines of manufacture.

The wisdom of holding prices in check when radical advances are possible admits of ready recognition. To reduce them under present conditions, however, represents a much more striking example of broad-gaged business management. This is the policy which the Linde Air Products Co., leading manufacturer of oxygen, has had in effect since the beginning of the war. This company bases its action upon the belief that, in the long run, the good will and friendship that will accrue will more than offset any increased profits to be gained from higher prices in a temporary market. The practical results netted by such a policy, approaching as it does the altruistic in business, no doubt will be watched with keenest interest by the general manufacturing world.



from the **IRON TRADE REVIEW**
May 18, 1916

A policy, an editorial and a chart

DURING the days of war when things were being turned upside down The Linde Air Products Company maintained its standards of uniformly pure quality, comprehensive service and *low price.*

While prices of other essentials were mounting up towards the peak the average price of Linde Oxygen was reduced, and, through the most trying period of the war, continued practically on an even keel. This splendid record was made possible by the great volume of business accorded to Linde by manufacturers and other oxygen users the country over.

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PROCEEDINGS *of the* AMERICAN WELDING SOCIETY

33 West 39th Street, New York

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EYE-PROTECTION OF WELDING OPERATORS

By William Spraragen*

WITH the enormous development of welding in the past few years and the impetus that is being given to that industry, our thoughts naturally turn to the safety precautions that are necessary to be taken for the complete protection of the operators from injurious effects of the welding arc and flame.

Arc Welding

Radiation to Be Guarded Against

The process of arc-welding is necessarily accompanied by the intense glare of the iron arc. Radiation from this arc may be divided under the three headings:

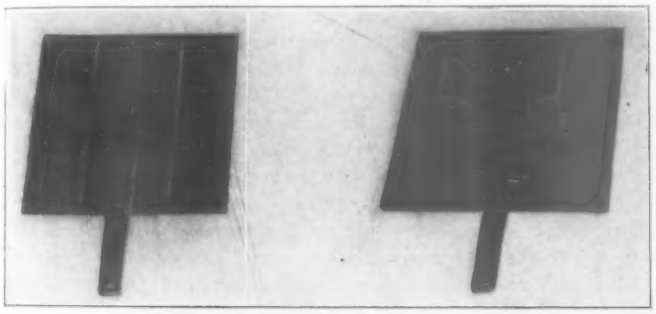

Fig. 1. Hand Shield.

(1) Visible light rays.
(2) Invisible ultra-violet rays.
(3) Invisible infra-red rays.

Effect of These Radiations

The visible light rays emitted by the electric arc, due to their intensity and flickering, cause a rapid irritation of the membranes of the eyes and eyelids.

When the invisible infra-red rays encounter parts of the body, they are absorbed and are changed into heat. These rays will, of course produce burns similar to sunburns and hence the eyes and any part of the exposed skin must be protected against them. Worse than either of these, however, is the slow insidious work of the invisible ultra-violet rays. They are the most to be feared as we have no organ or sense for detecting their presence. The ultra-violet attacks the tissues with an actinic effect. Cataract and blindness result from exposure and even temporary flashes from the arc are dangerous.

In addition to this, any exposed skin, as face and hands, must be protected from the sputtering of the electrode which throws off minute particles of molten steel. Irritation of the eye and sunburn may also be produced by the reflected light from the operator's own arc or the arc of adjacent operators.

How Protection May Be Secured

Contrary to the usual belief, complete immunity from the dangers mentioned above is quite simple and involves the following four features:

(1) Cutting down the brilliance of the visible arc for observations by the eye.

(2) Exclusion from the eye of the invisible, ultra-violet and infra-red rays of the arc.

(3) Protection against glare and side flashes.

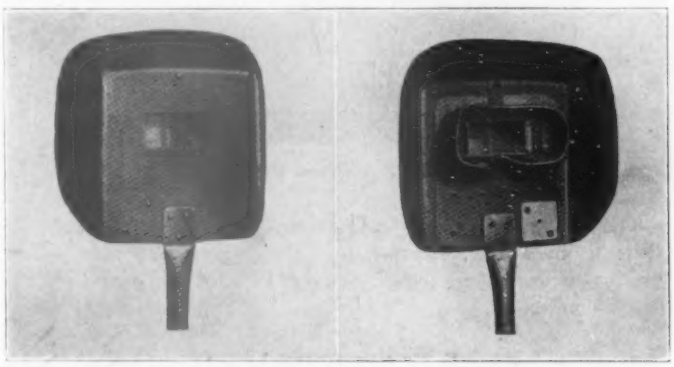

Fig. 2. Shield for Metallic Electrode Welding.

(4) Protection of skin and clothing.

For electric welding, welders use either face shields or masks. These serve the double purpose of protecting the eyes of the operator and also shielding his face from the heat rays, ultra-violet radiation and flying particles of steel. Fig. 1 illustrates the front and back view of a hand shield which is made of light wood and has a safety colored glass window in the center. Fig. 2 illustrates another type of shield commonly used when welding with the metallic electrode. It consists of a light fiber frame provided with the same glass window as in Fig. 1. Both types of shields are also used by inspectors and others who require the protection only for short periods and at infrequent intervals. The light box frame surrounding the window is fitted to the operator's face and prevents light from the side or rear reaching the operators' eyes thus preventing any interference of a number of operators due to the light from the arcs. These colored glasses are readily replaceable and are protected on the side nearest the arc by a piece of plain white glass to prevent the hot metallic particles thrown off from ruining the more expensive covered glass.

*Secretary, *Engineering Division, National Research Council.*

For carbon arc welding, which requires the use of both hands, and for heavy electric welding, it is common practice for the operator to protect his eyes and neck with a helmet fitted with a round or rectangular window of safety glass. While not always liked by welders, the helmet really affords better and surer protection to the operator. In metal arc welding it also permits the operator to use one hand as a support, thus enabling him to hold a steadier arc. These helmets are usually made of some strong light material such as vulcanized fiber and are designed so that they can be slipped on and off easily, the weight resting on the shoulders of the operator. A useful form of helmet with a circular window is shown in Fig. 3.

In order to furnish protection from the reflected light of adjacent arcs, each operator should be surrounded by wood or canvas screens painted flat black. For working in confined spaces or in welding alloys containing zinc, a helmet artificially ventilated by compressed air should be worn. The shield or helmet adequately protects the skin and neck from burn. To protect the hands both from the light and metallic particles, gauntlet gloves may be worn while a full canvas apron is useful to protect the clothing.

Fig. 3. Welding Helmet.

The safety devices mentioned are naturally subject to modifications to meet the requirements of special work. The safety glasses used in both the shields and helmet are of course replaceable.

Safety Glasses

There are a great many different kinds of special safety glasses on the market and many combinations of ordinary colored glass are also in common use.

A good safety glass should couple the greatest amount of safety with the clearest definition or visibility. In metallic arc welding it is desirable that the operator should be able to distinguish between the molten metal and arc itself. This is readily accomplished by selective transmission in that the arc is given a slightly different color than the molten metal when viewed through the safety glass.

In order to secure the clearest vision with the least amount of glare, densely colored glasses should be used that will exclude most of the red rays and practically all blue and violet rays, while the orange, yellow, and green rays should be toned down to the lowest degree consistent with clear observation of the work in hand.

The type of safety glass and color tint should be determined by an expert in accordance with spectroscopic analysis. On the other hand, the depth of the tint or the amount of obscuration may be best determined by the operator himself, as one man may be able to see clearly through a glass that would obscure the vision of another. The proper tint will in nearly all cases just permit the individual operator to clearly distinguish a lighted incandescent light when viewed through the colored glasses.

Glasses dense enough to tone down the intense glare of the electric arc to an extent comfortable to the eye will always afford sure protection against ultra-violet radiation. Most of the reliable dense colored safety glasses on the market are also good shields against heat rays, so there is very little danger, if any, to be apprehended from this source.

A red and green glass with a plain white glass on the outside form a desirable combination. Another excellent combination is a flashed dark ruby glass between two pieces of emerald green glass. The use of a blue glass should be avoided, as most of the eye strains in welding work may be attributed to this source. In selecting colored glasses, great care should be taken to discard all samples that show streaks or spots, as these defects are liable to produce eye-strain. The glass should be uniform in color and thickness throughout.

Gas Welding

Eye Protection

In gas welding injury to the eyes may result from the heat and glare of the work or from flying particles of hot metal. Properly colored lenses fitted in goggles will furnish complete protection to the eyes. Amber and greenish yellow are desirable tints for protection but here, as in electric welding, the choice of the type of glass should be left to an expert. The expensive colored lenses may be protected from injury by flying sparks, by a clear glass lens placed on the outside.

Goggle frames should be of a material which is a poor conductor of heat although padded metal frames may also be used. In addition, the hands and clothing should be protected from the heat and flying particles of molten metal.

Protection of Bystanders

The protection of bystanders is an important problem in connection with welding which is too often neglected. The disastrous consequences which generally result from such neglect are exemplified in the following case:

Dr. C. R. Kindall, surgeon of the Bureau of Mines, has issued a report in which it is stated that 30 men were recently viewing the demonstration of a new portable electric arc-welding outfit and a few hours later 17 of the 30 men reported to the doctor for treatment. They were suffering from traumatic conjunctivitis. In two cases the pain was very serve and the symptoms were similar to those of iritis. Morphine had to be administered to afford relief from pain. Only two men of the 30 were not affected in some way from this exposure. These two men wore thick-lensed orange-colored glasses. Several of the men wore orange-colored glasses with thin lenses, but the latter were not heavy enough to afford protection against an exposure as long as took place.

Symptoms and Treatment (copied from November, 1920, issue of General Electric Review)

The symptoms of conjunctivitis caused by intense light or by the ultra-violet rays are abnormal intolerance to light, excessive secretion of tears, intense smarting of the lid, contraction of the pupil, sometimes swelling of the lid, and small ulcers developing on the eyeball or cornea. Unless properly treated by a physician immediately, chronic inflammation of the conjunctiva, cornea, iris, or retina, and possibly blindness, may result.

Under proper treatment most cases get well in a few days. All treatments should be under the direction of a physician. That usually advised is to place ice packs on the patient's eyes three or four times daily. The pack should be left on from 15 minutes to an hour. The eyes should be irrigated with normal salt solution (a teaspoonful to a quart of sterile water), or a saturated solution or boric acid several times daily. If there is a discharge of pus, a few drops of a 25 per cent solution of argyrol or a 5 per cent solution of protargol should be placed in the eyes three to six times daily. The patient should be confined to a darkened room until his condition improves in order to avoid complications. These treatments will reduce the swelling, give the patient comfort and prevent the development of

(Continued on page 32)

STUDDING FOR ARC WELDING

By C. J. Holslag

THE writer encounters the prevailing notion about the country that in the electric arc welding of cast iron, studding is resorted to to entangle the parent metal in the metal of the weld, similar to the wooden skewer stuck in a piece of meat prepared for roasting. Such is absolutely not the case. This method of studding was thought out, designed and developed; and my engineering spirit resents the inference that the studs are placed there to function similiarly to the pegs in a shoe.

Assuming that steel can be welded to cast iron where the parts are free to align themselves, which assumption is a fact, the use of studding comes in where the weld is in such a position that the parts are not free to align themselves to the contracting strains which result during cooling. In the latter case, a steel weld made to cast iron without studs looks fine until just about the time it is being most admired during cooling, when it invariably cracks along the edge of the weld. This is easily explained when we consider that steel has approximately four times the strength of cast iron. The definite location of the break comes about because the cast iron next to the weld has become chilled cast iron, no matter whether it was originally so or not, and a sharp demarcation of structure together with a possible layer of weaker cast iron causes the break invariably to take place in this layer of cementite.

If, however, steel studs are properly distributed along the face of the cast iron to be welded or adjacent to the joint, so that the weld cannot pull away from the cast iron, the cooling strains result in stretching the steel weld, and the union between the weld and the cast iron and steel studs is maintained as it was made.

That it does not harm steel to strain it, even beyond the elastic limit, is a fact not generally known; and I would refer any doubter of this to tests where the ultimate strength of steel has been increased by stretching it beyond the elastic limit. To make this clear, it is only necessary to refer to the well known fact that working steel increases its strength and other desirable physical properties. The point I am trying to make is that it does not injure the weld to subject it to strains even beyond the elastic limit. Of course it may happen that these strains are such that, in work done too rapidly, the weld stretches beyond the ultimate strength and a crack appears. This occurrence is no cause for apprehension, because this crack can be veed out and rewelded, in which case, you are welding steel to steel, and the crack being much smaller than the original one, the break is not likely to occur again.

How to insure the proportioning of the studs so that the weld does not pull away from the cast iron is a very simple engineering problem, now that the way has been shown; but one that required real initiative on the part of the pioneer. As nearly as I can find out, the man to whom the world is indebted for this method of successfully welding cast iron is Mr. Joseph McAllister of the New York Central Railroad. It was he, who, upon discovering the ordinary trouble in welding cast iron, developed this studding system, not by guess work, but by design, having had similar problems to contend with in boiler construction. It was he, who, together with Mr. H. A. Currie of the New York Central Railroad and Mr. D. H. Wilson of the Erie convinced the Navy Department that the interned German ships' damaged cast iron parts could be successfully welded. Mr. McAllister laid out the first successful job on these ships and his welders, trained in this work, made possible the speedy restoration of these engine parts.

Arc Welded Spoke of Heavy Wheel.

Good Repair Work on Casting.

Remembering that steel has four times the strength of cast iron, the problem is to so proportion the studs that the ratio of the cross section of the steel to the cross section of the remaining cast iron is something less than four to one at any one section that will be subjected to cooling strains at one time. This, in general, is a very simple and easily applied method and means, in general, large studs for large sections and smaller studs for smaller sections. Common sense together with welding experience is required in placing the studs. The writer has seen this studding method abused horribly by people who evidently did not understand why they were using this method; and there is no doubt that some of the unsuccessful work done by amateurs is partly due to the prevailing opinion that the studs are simply there to functions as tent stakes. That this is not true, can also be seen from the fact that the steam tight joints on cast iron can be made by this method, showing that the weld to the cast iron has been maintained in full efficiency by the use of the studs.

Another very useful application of studding is the use of large studs as an anchor or nucleus for breaks in castings such as gear teeth. One to three of these large anchor studs, together

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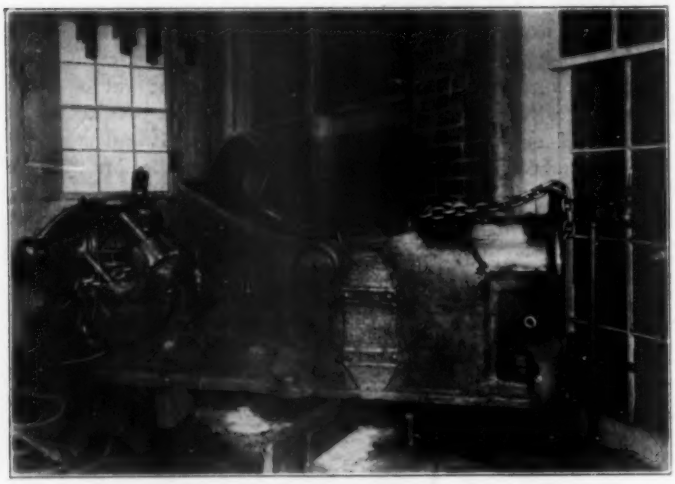
**Paper presented before the Metropolitan Section of the American Welding Society at New York City on January 18th, 1921.*

†Chief Engineer, Electric Arc Cutting & Welding Co.

with some smaller regular studs appropriately distributed will provide the necessary weld strength to the cast iron as well as strength to withstand some shear and thrust strains. The weld, built up to size and machined off, furnishes a perfect wearing or bearing surface. This latter method of studding is also applicable to cast steel, where the original section has not been adequate to withstand the strain.

Details of how to accomplish this studding which are not explained by the photographs are:

First: Vee out the crack on both sides of the break from



Welded Patch.

one surface, if only one is accessible, or half way from both surfaces if both are accessible for welding; saving enough parts of the original break to keep the piece securely clamped in alignment. Before any of the welding is done, the stud holes are to be drilled and tapped with a *bottoming* tap, and the studs screwed in tight, completely filling the hole for a distance of at least four times the diameter of the stud. A convenient way of doing this is to have rods threaded for their entire length, screw these in tight, and saw off ¼-inch to ⅜-inch above the surface of the

Prepared for Welding with Studs.

work depending on the accessibility. That is to say, a narrow vee should have the studs closer to the work than a more open one.

Second: In welding, the following procedure should be carefully adhered to. Weld around the studs so that they are part of the cast iron; then weld between the studs crosswise or diagonally until the entire surface of the cast iron that has been veed out and the adjacent surface forming the underside of the pad is completely covered before proceeding with the main filling in. That is to say, add metal, one bead at a time, so that no great section of the weld congeals from the molten state at any one time.

First welding the stud to the cast iron makes the stud an integral part of the casting. Welding from stud to stud diagonally or crosswise draws the fractured surfaces together to their original contact, if a small amount of the original break has been left intact at the bottom of the vee. This can be done in most instances; but, naturally, not if pieces are broken out and lost, and must be replaced by a casting or forging. In this steel studding process for cast iron, especially on cylinders and the like, machining is often necessary subsequent to welding, and the hard stratum of metal directly under the weld prevents ordinary cutting operations and grinding must be resorted to. There are other means of taking care of this hardened layer for machining on the surface, one of the newest of which is to finish the machined part with a nickel-copper electrode, which electrode has the property of so merging the cast iron that there is no hard layer of cementite formed. This electrode was developed by the automobile trade for repairing scored cylinders and the like. Older methods are to calk the bottom of the vee, say with copper, which is machined off later. Probably the best method of all is to supply a bushing for the finished part. Many cylinders, especially those of steam engines, are built with this bushing originally; and, in welding, the bushing is to be removed and perhaps slightly refitted after the welding job is finished.

There is no mystery about the electric weld making the cast iron hard at the joint. It is simply that the cast iron is heated up to the welding temperature necessary, and is chilled by the adjacent mass of cold iron. Chilled cast iron has always been hard and probably always will be.

Cast iron differs from steel in containing 3½ per cent carbon, more or less, whereas steel, even the hardest, contains less than 2 per cent carbon, and 98 per cent of all steel in the world has less than 3/10 of one per cent carbon. The cast iron with the same amount of carbon in it may have the carbon in two forms, i. e., combined and uncombined (graphitic). In the combined form, the cast iron is very hard. In the uncombined form, it is comparatively soft, easily machined and can be calked. Various degrees of hardness range between these two limits according to whether all of the carbon has flaked out of the combination into graphite, or whether some remains in combination. The conditions as to whether the graphite will be separated, or remain in combination, depend on the rapidity of the cooling from a temperature just above a red heat. If it is cooled rapidly, there will be no time for the graphite to come out of combination. If it is cooled very slowly, the graphite will all come out of combination and various degrees of hardness are obtained by different rates of cooling. A form of cast iron called malleable cast iron is less used, in which, after weeks of slow cooling, the graphite settles to the outside and is taken off the cast iron, and it begins to take on the properties of wrought iron. As already said, this is a long process, and real malleable iron is rapidly going out of use due to the time taken to make it. So-called malleable iron is generally cast iron with very little of the graphite removed.

In making a weld on cast iron cold, naturally, the cast iron is cooled very quickly, or chilled just below the joint of the weld and sometimes the weld itself will be very hard because of the very quick cooling. This occurs whether welding with a steel electrode or with a cast iron electrode. This chilling, hardening effect can be removed by reheating and annealing in lime or warm sand, or any way to allow it to cool slowly from above a red heat.

To avoid this hardened layer when welding with steel, or to avoid the hardness of the entire section when welding with cast iron, the following procedure must be followed: When the piece is of such shape that it can be welded cold, reheating and annealing will render it capable of being machined. This can be done at any time after welding, by bringing the weld and adjacent cast iron up to a little higher than a red heat and allow it to remain there from two to ten minutes, depending on

the size of the piece, than cooling slowly by burying it in warm sand, fire clay or lime. When the piece is of such shape that the cooling strains when welding quickly, as in electric welding, would warp or break the piece, preheating is necessary; however, only to a small degree; that is, less than red heat, in order to save the piece from breaking while welding. Directly after welding, the weld and adjacent cast iron should be heated a little higher than a red heat and annealed as before. This method results in welds made either with steel or cast iron electrodes being easily machined throughout. Welds made with a cast iron electrode are not distinguishable from the original cast iron by either physical or chemical analysis.

In general, cast iron containing small amounts of steel, so-called semi-cast iron (semi-steel), is much easier to weld than pure cast iron.

Generally, the only welding executed on cast iron, except in the case of accidents, is where the original cast iron is defective because of sand holes, porous spots or other flaws occurring during casting. Such sand or slag must be entirely removed before satisfactory welding can be expected.

Usually, the cast iron electrode, while it becomes more fluid

A Difficult Weld, Well Finished.

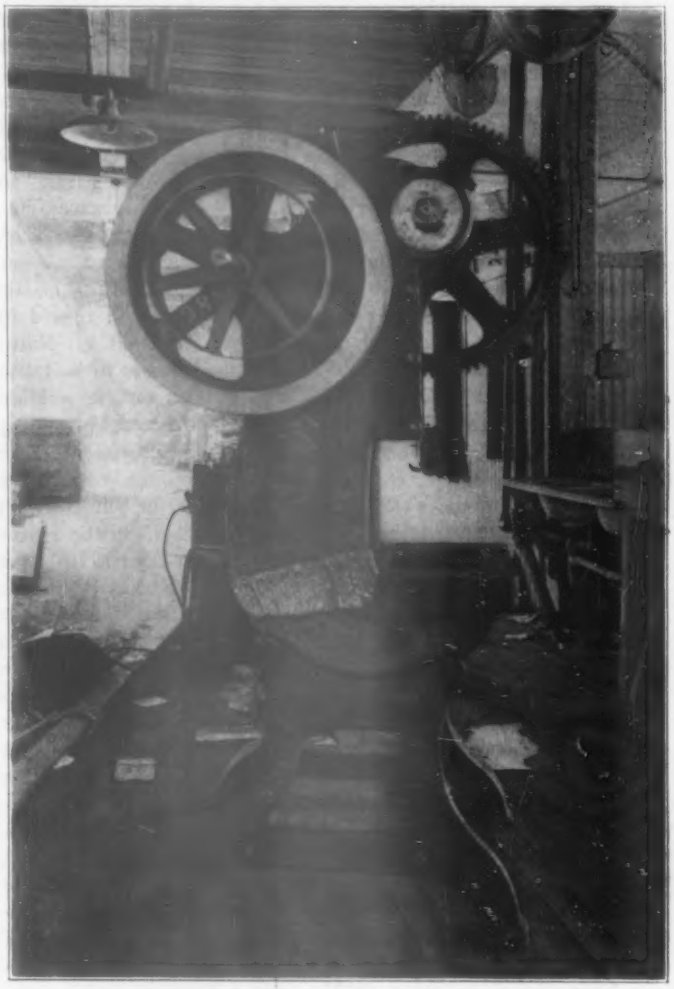
than steel under the arc, cools more quickly than steel and from the outside inwards; while steel cools from the inside outwards by the conduction of the heat in the weld into the adjacent metal. Hence with cast iron there is more chance of voids and gas bubbles being left in the weld, and some sort of flux to prevent this is necessary in depositing cast iron; desirable ingredients in such a flux being:

1. A quieting reagent.
2. A quick floater of dross to the surface.
3. A protector against oxygen and nitrogen, so that bubbles, films or needles of oxide and nitride are not left in the weld.
4. Protection against rapid cooling of surface.

The studding of cast iron is not necessary in all cases, for instance:

First case. Simply as a means of filling in, or building out, where grinding is the only machining necessary. Clean out the spot to be welded by chipping or grinding so that all dirty, oily, sandy, or porous metal is cleaned away and a reasonably bright metal foundation is provided for the weld. Weld with either a steel or cast iron electrode according to whether a reasonably hard or a very hard surface is wanted after grinding. The steel gives a hard surface and the cast iron a very hard surface. Care must be taken in using the cast iron electrode that the quick cooling does not entrap gas bubbles in the weld, leaving holes after finishing. The steel causes no such trouble, but if slight imperfections should show, peening will close them up.

Second case: Welding cast iron where tensile strength is required, but not resistance to bursting pressure; such as welding broken machine parts, small bed-plates, etc. In general, where no undue strain will be encountered and the part was originally broken by some accident which will hardly happen again in the same place, proceed as follows: Vee out the break wide enough so that the electrode can be held at approximately right angles to either face of the vee. Cover the two faces of the vee separately with steel, using great care to have the steel united to the surface of the cast iron as the arc progresses, and not to let any of it run down ahead of the puddle. Weld from the bottom up; and, if any of the deposited metal does get away, stop and chip it off. After the two faces are successfully covered, it is extremely easy to make a good weld from the steel faces, using steel or cast iron in the vee.



Restored to Service by the Arc.

Cast iron will not endure any considerable deformation. In other words, it cannot be bent, stretched or changed from its original shape in any manner without breaking or cracking. To relieve the stresses, set up in welding cast iron cold, the weld must contract. If the shape of the cast iron pieces is such that one or both ends cannot move with the weld, something must give way. If the weld is one-quarter or less of the section of the cast iron and a good joint is made to the cast iron, the weld will hold; because the weld, even if of steel (the steel being four times as strong as the cast iron) will stretch if it is one-quarter or less in area. However, it does not hurt the weld to stretch. It is similar to working steel after casting into forgings and rolled shapes. If the weld can be put on a little at a time, so that its cross section is also less than one-quarter of the cast iron which it is welded to, results can be obtained which will not bend out of the original position, even on a section that is ultimately the same size. The foregoing applies to welding with steel electrodes. In welding with cast iron electrodes, the rela-

tive strengths would be the same, but due to the cast iron weld not being able to stand any deformation, it would crack through the weld. The remedy for this is to preheat the parts to be welded so that they will all contract at the same rate. In this manner, welding with a cast iron electrode is much more rapid and more satisfactory than any other process. The arc has a tendency to burn out the carbon in any weld, and this is especially true where the carbon approaches 3½ per cent. There has been developed a coating for the electrodes which replenishes the carbon, so that true cast iron of the same nature as the original results in the weld.

There is another method which has a basic theory similar to studding, and is especially useful for sections that are too thin to stud; that is, automobile cylinders, jackets, crank cases, heating boilers, and other cast iron parts complicated in shape, and which can tolerate no deformation. This is to run beads at right angles to the crack about eight to ten times the thickness of the weld at the crack, with right angle beads laced back and forth at intervals of four to six times the thickness of the piece to hold the weld and adjoining cast iron from separating; so that the contraction takes place in the weld where it does no harm. In this manner automobile water jackets, crank cases, furnaces, etc., have been welded. Automobile water jackets have also been welded in emergencies without taking the water out of the engine. Sometimes the weld will be stressed beyond its elastic limit and crack, but no precautions need be taken in regard to rewelding, as this crack will then have steel to hold it. Naturally, the less heat used, the less will be the stresses to be taken care of. To that end, use the light work taps on the welding machine to secure as little heat as possible. Proceed by welding a little at a time, allowing one bead to cool completely before beginning the next one; except in the case of filling in the beads at right angles to the weld, which beads should be put down as nearly as possible at the same time in order to fill in the spaces between the intermediate crosswise of the crack beads. In pieces that have cracked and sprung apart and should be brought into alignment, this method of crosswise beading, proceeding from the smallest end of the crack, will bring the orignial pieces into such intimate contact that it is very often water-tight before starting the intermediate beading. In order to keep the heat as low as possible, a special electrode, whose melting rate is higher than ordinary steel, should be used. You will find this will aid materially in keeping the stresses down. All of this welding with steel is done without preheating or annealing of any kind, the necessary finishing being done by grinding. I know an operator who has not seen anything but cast iron welding for so long that he probably has forgotten how to weld steel, and the majority of cast iron work in a jobbing shop can be done without studding. In cases of scored cylinders, if the machine can be set so that it will draw an arc, but not sustain it, the metal can be deposited in one flash at a time; without cracking the adjacent cast iron, by using a special nickel electrode. In the case that the machine cannot be set at half-voltage, a foot switch in the secondary circuit or the primary circuit should be opened, as each drop is deposited so as not to use the high heat in depositing the metal. If a nickel electrode is used, the weld must be calked in place, but a special electrode of nickel and copper can be run continuously, providing the cast iron wall is thick enough to stand it.

To sum up: cast iron welding with the electric arc is just as useful as with gas and a great deal quicker and cheaper when the parts are preheated. Also, as pointed out in this paper, there are a great many places where electric arc welding is possible without the trouble of preheating and often where preheating would not be possible.

APPOINTMENT OF MR. HENCH

L. W. Hench has been appointed secretary and general manager of the International Oxygen Co., succeeding Eugene Schoen, resigned.

ORGANIZATION OF THE SCHENECTADY (N. Y.) SECTION OF THE AMERICAN WELDING

On Monday evening, January 17, 1921, a number of members of the American Welding Society and others interested in welding, residing in Schenectady and vicinity, met in Edison Hall, Schenectady, N. Y. Mr. W. S. Symons, treasurer of the American Welding Society, and Mr. William Spraragen, secretary of the American Bureau of Welding, attended this meeting.

Owing to the sudden change in the weather (the temperature having dropped down to about zero with very high wind velocity), the attendance was much less than it would otherwise have been, but notwithstanding the adverse weather conditions, there were some thirty or thirty-five gentlemen present at this meeting which was presided over by Mr. H. L. Unland, of the General Electric Co., and after making preliminary remarks with respect to the purpose of the meeting, he called on Mr. Symons to address the meeting on the purposes and objects of the American Welding Society and the advantages to be gained by membership therein. Following Mr. Symons' remarks, Mr. Spraragen addressed the meeting, pointing out the relationship between the American Welding Society and the American Bureau of Welding and the advantages that would accrue from the results of the work of their research committees in their local section.

Following the foregoing proceedings, which were under the auspices of a temporary chairman and secretary, the chairman announced that an expression would be in order from those present as to their views with respect to forming a local section. In response to this, one of the influential members spoke strongly in favor of forming a section at Schenectady, and moved that such a section be formed and that officers and directors be elected and committees appointed. The motion was promptly accepted and unanimously carried by rising vote.

The chair then announced a Nominating Committee, which retired and after some period of deliberation returned with a full list of officers and directors which would be necessary in their organization. A formal vote was taken, resulting in the unanimous election of all the officers and directors named as follows:

Chairman, R. H. White, American Locomotive Co.
Vice-chairman, W. H. Namack, Davison & Namack Co.
Second vice-chairman, E. J. Murphy, United Traction Co.
Secretary, R. D. Reed, General Electric Co.
Treasurer, W. N. Golden, Schenectady Railway Co.
Directors for one year: A. B. Appler, Delaware & Hudson R. R. Co., and J. Weiss, New York Central R. R. Co.
Directors for two years: S. R. Stockholm, Troy Electric Welding Co., and W. H. Reickman, Boston & Maine R. R. Co.
Directors for three years: F. Willard, American Locomotive Co., and P. O. Noble, General Electric Co.

The temporary chairman then declared the Schenectady Section of the American Welding Society as having come into existence. A further resolution provided that a notice of their action should be sent to the parent society with a request for a charter under which the Schenectady Section would function and that they would send, as soon as completed, a copy of their constitution and by-laws which is to be patterned after the one now adopted by the Philadelphia and Metropolitan Sections.

The Schenectady Section, therefore, starts off with an approximate membership in excess of thirty, which, in all likelihood, will be increased to fifty or seventy-five in the course of a very few meetings.

OXY-ACETYLENE CUTTING
SOME APPLICATIONS

By B. Heyman*

UNUSUAL applications of the oxy-acetylene welding blowpipe, in various industries, both as a medium for effecting economy or for producing otherwise unattainable results, have become rather common topics in many of the technical publications. On the other hand, very little attempt has been made to indicate what unusual results can be obtained with the cutting blowpipe, either in manufacturing processes, where production is of prime importance, or in such industries as wrecking, scrap cutting, etc., where speed and economy are essentially the controlling factors.

The principle of the cutting blowpipe is in itself very simple, although the actual design of an efficient and durable model brings up manifold difficulties. The process consists in rapidly oxidizing and blowing out the oxide from the material being cut. The metal is first heated locally, and then, a jet of pure oxygen, traveling at a very high velocity is directed in such manner at the preheated metal that the oxidation reaction progresses rapidly through the mass, the oxide freeing itself readily and dropping away. The reaction may be expressed in simple form as iron ÷ oxygen = iron oxide.

The opening produced is known as the kerf. Its width and general characteristics depend upon the design of the blowpipe and method of operation. The number of preheating flames and their intensity, the velocity, thickness, and direction of the cutting jet each produce peculiarities. Oxidized surfaces, rounded upper edges, slaggy lower edges, rough surfaces, etc. may be attributed to one of many causes, provided the material being cut is of average quality, both as to composition and structure.

Only wrought iron and steel can be cut economically. The theory which was advanced until recently in explaining the latter statement was based upon the differences in the temperatures of the oxide formation and metal fusion. It is a well known fact that as the carbon content of the steel iron group increases the melting temperature of the metal falls, while the temperature at which the oxide forms rises. Thus wrought iron and low carbon steels form their oxides before fusion of the metal occurs. High carbon steel, which has a small percentage of uncombined carbon, forms its oxide almost at the same temperature at which the metal itself melts. Difficulty is experienced in cutting this material.

Cast iron, with a high graphitic content, was considered impenetrable to the cutting jet until only a short time ago. Although it was possible to introduce enough heat to form the oxide, still, the cutting action was clogged, due to alloying of the molten metal with the oxide.

Within the last few months wonderful developments have been made in elaborating on the theory covering the cutting of the steel and iron group. Furthermore methods have been developed, whereby cast iron can be cut. In fact, this practice has become so simple that where other methods of separating large masses of cast iron are not available, the oxy-acetylene blowpipe can be utilized to advantage. The process, however, has not been developed to such an extent that it can ever hope to displace or even compete with ordinary scrap yard methods, namely skull-crackers and the like.

The process differs materially from that of steel cutting in that the flames are carbonizing; the metal must be preheated until almost molten, before the cutting jet is applied; the torch must be held further away from the metal, allowing the oxygen to be warmed; but most important of all the torch must be so directed that the jet travels backward at an angle of about 20 to 25 degrees from the vertical and must be directed in small semi-circles while progressing along the cut.

As the success of the process depends mainly upon blowing out a mixture of oxide and molten metal a very large cutting jet is required. Furthermore, the time required for cutting a section of cast iron is more than twice that for an equivalent section of steel. It will be seen from the above why cast iron cutting has such a doubtful future as an economic success.

At a recent demonstration in which one of the most expert cutters was used, the following figures were obtained on several cast iron sections.

Thick. ins.	Length ins.	Oxy. lbs.	Press per sq. in.	Acety. lbs.	Press. per sq. in.
2¾	11.3		130		5
6¾	4.3		140		5

Oxy. cub. ft.	Acety. cub. ft	Preheating min.	Time sec.	Cutting min.	Time sec.
44.5		0	20	2	38
42		0	6	2	24

The average operator could never hope to equal the above record. And comparison of this with cutting tables furnished by any cutting apparatus manufacturer indicates very definitely what an expensive proposition it is, unless no other method is available.

It is claimed by some manufacturers that it is only by the use of their type of blowpipe that cast iron can be cut. They ascribe this to the type of flame which they produce and to the action of the cutting jet.

Any blowpipe can be used providing enough heat is obtainable and the cutting jet is made powerful enough. Preheating the cast iron by some external agent—charcoal or oil burner—makes the cutting much easier.

With a cutting jet .0787 inches in diameter and oxygen pressure of 45 to 75 lbs. per sq. in. it is possible to handle material from ½ to 2 inches in thickness. With a cutting jet .118 inches in diameter and oxygen pressure of 85 to 175 lbs. per sq. in., cast iron from 3 to 12 inches in thickness can be cut. It is essential that an excess of acetylene from 1 to 2 inches long be used.

The cutting of steel does not require any special methods as in the case of cast iron, but there are times when the work is of very peculiar nature. Such a case occurred recently when the cutting blowpipe was successfully employed at the Singer Mfg. Co., Elizabethport, N. J.

This consisted in removing a 40-ton cast iron fly-wheel from a 1,600 horse-power cross-compound Corliss engine. The fly-wheel was made in 8 sections, adjoining sections being held by several large bolts at the hub, while the rims were joined by large steel forgings in the form of links. Each joint had two of these links shrunk into a recess, leaving very little clearance between the cast iron and steel. In order to remove the steel links several methods were considerd, but the cheapest and quickest appeared to be chipping, drilling, or oxy-acetylene cutting. The two former were discarded, due to lack of time and the high cost entailed for labor, etc.

In order that the removal of the links be facilitated, the operator was instructed to produce a very wide kerf to permit the insertion of crowbars. This necessarily meant a much higher oxygen and acetylene consumption than would ordinarily be required for cutting metal of an equivalent section. Moreover, be-

*Philadelphia Cutting, Welding and Brazing Co.

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cause of the unusual conditions imposed on the operator, namely, blowing a 6 inch deep hole to a blank wall and then cutting against this wall, a slightly higher oxygen pressure was needed to insure complete removal of all metal in the form of oxide. Leaving even a small particle of metal holding the parts of the link meant insertion of the torch into a deep hole to blow away the fragment. The intense heat flaring back was a serious drawback and caused the destruction of several nozzles, which were made of brass, at the times when the operator was thus trapped.

An Oxweld cutting blowpipe was used for the work. The No. 4 nozzle with a .118 inch cutting jet and oxygen pressure of

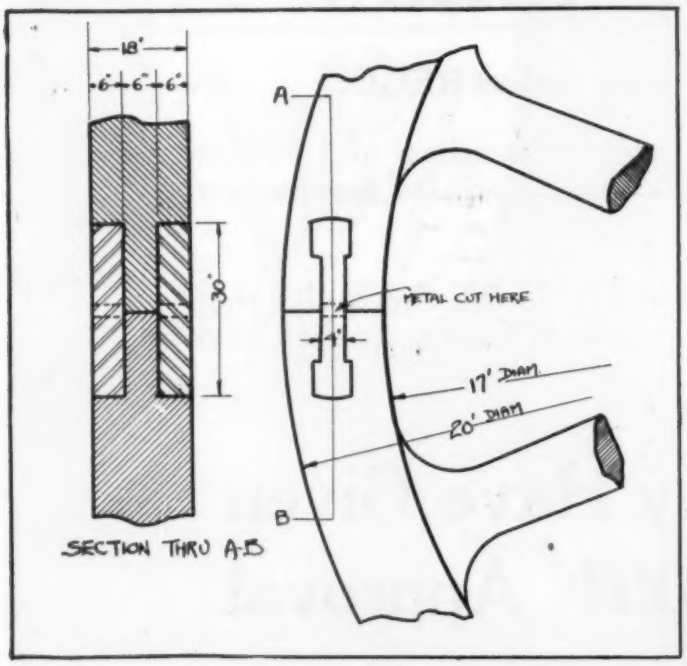


Fig. 1. Position of Links in Wheel.

90 lbs. per sq. in. was employed. Approximately 400 cubic feet of oxygen and 40 cubic feet of acetylene were consumed in making 16 cuts, each 6 inches deep, 4 inches long and 2 inches wide. The links and their position in the fly-wheel are shown in Figure 1.

Removal of the links was completed by using pinch bars and the fly-wheel was then taken apart very easily by removal of the hub castings, thus facilitating removal of the entire engine, for shipment to its new foundations.

In the cutting of dies and cams, the cutting blowpipe can become a very valuable aid. It is a simple matter to cut the steel to approximately the finished dimensions, leaving enough for finish on the milling machine. The difficulty which most people experience in this type of work is due mainly in the hardening of the kerf surfaces, making it difficult to machine. This can be overcome to a great extent by preheating before cutting, and the use of flames on the blowpipe of very low intensity.

In the nicking of billets, for use in manufacturing shells during the war, the cutting blowpipe proved itself to be one of our most valued tools. Without it there is a grave doubt as to how slow production would have been, as no friction saw or other means could compete with the simple method of cutting a shallow groove on the surface of the billet, which was then snapped in two by applying a sudden force. There are many peace-time occupations of similar nature to which it can be adopted in manufacturing establishments where steel stock is now laboriously cut in two by old fashioned hack saw methods.

In shipyards, locomotive shops, boiler shops, there is no handier tool for removing rivets, staybolts, cutting out defective sections; while in the steel mills and foundries, the cutting blowpipe has been accepted as a standard tool and used as such in the removal of risers, cutting of stock, and the innumerable other uses to which it may be adapted in these industries.

EYE PROTECTION FOR WELDING OPERATORS

(Continued from page 24)

chronic conjunctivitis. In sever cases it may be necessary to administer morphine to relieve the pain.

All of the eye trouble recounted was caused by neglecting to observe simple and well known precautions. The glare from an intensely bright point of light like the electric arc, even at a distance of 20 or 30 ft., may prove a source of injury to many eyes, although at this distance all injurious ultra-violet rays would be absorbed by the air.

All harmful effects to the eye from the radiations of the iron arc may be entirely avoided by the exercise of a little common sense and intelligent caution.

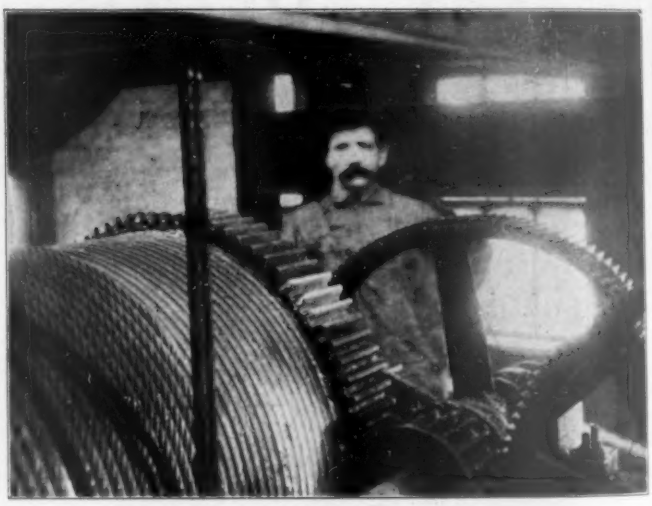
Conclusions

The author is greatly indebted for certain material in this article to the work of Mr. W. S. Andrews.

Further information on the visible transmission of eye protection may be obtained by consulting Bulletins Nos. 119 and 148 of the Bureau of Standards.

OXY-ACETYLENE ENDS TIE-UP IN NEW YORK GARAGE

Due to a break recently in the drum gears of a large elevator, the cars on the upper floor of a five-story New York garage were marooned from Saturday afternoon until Tuesday noon. The break occurred at an hour when the floors were partially emptied, and suspension of elevator operation not only tied up the cars above, but so crowded the ground



Gear Teeth Repaired at Nominal Cost.

floor that dozens of motor cars had to be parked on the street at night.

Not until it was found that replacement of the broken gears would be impracticable, owing both to delay and excessive cost, was an oxy-acetylene welder called in. An outfit was set up and work started at 1:00 P. M., Monday. The welds were completed by 8:00 P. M. the same day and were left to cool overnight. By noon Tuesday the teeth were finished off with a file and the elevator was at once put back into service, releasing 115 cars that had been tied up since the preceding Saturday afternoon.

The cost of the repair was nominal compared to the price of a new drum, which would have cost $600, and the time was as nothing to six months' delivery, which was the best the factory would guarantee. Still, for one memorable Sunday some of Gotham's most enthusiastic motorists were given a taste of what Blue Laws in Manhattan would mean to them.

SUPER RISER CUT

The cutting of super-size risers, sometimes presents problems that puzzle even the men whose daily work is dealing with these monsters of the foundry. The successful handling of such problems frequently brings out solutions of great practical value to the industry.

An example of this kind was illustrated at the plant of a large foundry company in Pennsylvania. This company has been handling heavy work for the past six or seven years, and the cutting of risers has been handled in various ways, the smaller cuts usually being made with the oxy-acetylene torch and the heavier ones being placed in large lathes especially suited to the work.

However, it happened recently that the unusual and knotty problem—the unexpected difficulty—arose. The specific case was the cutting of a cylindrical steel riser 5½ feet in diameter, 4 feet long and having walls some 15 inches in thickness. The casting, together with the sand and cores, before cleaning, weighed ninety tons. It was an air compressor casting, and weighted sixty tons net, shorn of its riser, core and mould. Being too large for cutting in even the largest lathe, the oxy-acetylene cutters were assigned to the job, but their equipment and experience on the lighter work with which they were familiar were not equal to the task before them.

An Unusually Knotty Cutting Problem.

After hours of difficult effort the operators barely succeeded in driving the cut through to the inner surface, making a small hole in the riser. The failure to get the cut under way effectively was due primarily to the light torches used and to the fact that they were connected with a single oxygen cylinder.

This fault was finally overcome by connecting two oxygen cylinders in manifold and using a heavy service cutting torch. The cut was then begun at the outer edges of the riser, where the cutting could be started more readily, and a panel (see illustration) was cut out all the way back to where the final cut was to be made. This had the effect not only of facilitating the start on the major cut, but enabled the operator to better handle the cut throughout, as the panel opening made it possible to work from either the outer or inner surface at will. Two fifty-ton cranes were used to turn the work as the cut progressed.

Cutting with the heavy torch began at 5:00 P. M., Saturday and was completed the following day. The actual consumption of oxygen was about 7.250 cubic feet. Including the panel there was 25.27 feet of cut (outside circumference) through steel 15 inches thick. The riser as cut weighed nine tons.

This is interesting as showing a successful method of handling the super cut under unusual conditions, and also as illustrating the emergency possibilities of the oxy-acetylene process.

MARKED SUCCESS OF GAS PLANT

A marked success during the first year of operation has been made by the Gas Products Co., of Columbus, Ohio, manufacturers of compressed acetylene oxygen and hydrogen, according to the annual report, covering the yearly period ending December 31, 1920. S. D. Winger, vice-president and general manager, attributes the growth of the company to the splendid support received from other local and surrounding industries, together with the encouragement of practically every important railway system in the state, which warranted extensive expenditures throughout 1920 for the enlargement of its producing and service capacities. Provisions have also been made for further immediate 1921 enlargements.

The production of oxygen and hydrogen, in addition to compressed acetylene, was commenced February 13, 1920. These new gas products called for the addition of a building 150 by 26 feet, a large oxygen gas holder, a hydrogen holder, a combined water and water distillation tower, a large reinforced concrete cylinder platform and additional motor trucking facilities.

A new central station boiler plant for heating the seven buildings on the premises was placed in commission in 1920.

During 1920 additional acetylene compressing, drying and purifying equipment was housed in a new building constructed for the purpose. A large reinforced concrete bay for the collection of hydrated lime and a deeply depressed acetylene cylinder loading pit with inclined motor truck runways to grade were added to the acetylene producing and service facilities.

The demand for oxygen has outgrown present equipment and now necessitates additional producing facilities. Activity towards such an end should see this improvement effective shortly.

CUTTING HOLES IN CONCRETE

Mr. B. A. Johnson, of Minot, N. D., has had very good success in cutting holes in concrete with the oxy-acetylene torch. The ordinary method of attempting to cut holes in concrete has been to work from the top, but Mr. Johnson introduces a new method, and that is working from the bottom. This method may be known to a good many of the readers, but it will undoubtedly be new to perhaps the majority. In a recent job he used a No. 10 tip with the ordinary welding flame and climbing up on a ladder with his new concrete "hole driller" he proceeded to drill or bore through 12 inches of solid concrete, at the rate of 12 holes through 12-inch concrete in two hours, or an average of ten minutes to the hole. The hole at the bottom was considerably larger in diameter than at the top, in fact, some of the holes were 6 inches in diameter, but on top the hole was a nice round 1-inch hole, and could easily be enlarged with a chisel from this point to any size desired. Ordinarily in drilling concrete one strikes large pebbles or large stones which turn the edges of the sharpest drill, and these are cracked into a hundred pieces the instant the flame hits them. It is advisable to use some protection for the operator on account of the flying pieces of concrete and stone.

GAS PRODUCTS ASSOCIATION CONVENTION

The Gas Products Association held a very successful Annual Meeting, January 14 th and 15th. One of the outstanding features of this meeting was the address made by Mr. M. L. Goodrich, President of the Association in which he outlined the progress made by the Association during the past year.

The Gas Products Association is composed of practically all the principal electrolytic oxygen and hydrogen producers and represents forty-two oxygen plants located in all parts of this country and Canada.

The Gas Products Association Dinner at Chicago.

After the business meetings were over the members of the Association and some of their friends gathered for their first Annual Dinner which was an enjoyable occasion for every one. Mr. A. J. Russell of Davenport, Ia., presided as toastmaster and the after dinner speakers included Mr. C. Moody, Mr. A. R. Small, Mr. E. A. Faulhaber, Mr. C. E. Phillips, Mr. M. Keith Dunham and Mr. L. B. Mackenzie.

PROPOSED ORGANIZATION OF CANADIAN WELDING SOCIETY

Working in harmony with a meeting held recently in Toronto relative to the organization of a Canadian Welding Society, A. M. Barry, manager of the St. Lawrence Welding Co., Ltd., of Montreal, called a special meeting of those in this district interested in the movement. The meeting was held last Thursday at the Windsor Hotel, and although the notice given was necessarily brief, a goodly number of firms was represented. Those present, besides Mr. Barry were:

A. McMillan, of the Canada Carbide Co.; C. Royer, of Welding & Supplies, Ltd.; A. F. Dyer, welding supervisor of the Grand Trunk R. R., at Point St. Charles; P. Reynolds, of the St. Lawrence Welding Co., Ltd.; W. G. Cole, of the Advance Machine Works; W. P. Bennett, of the Canadian Welding Works; T. Jones, of the Canadian Vickers Co.; H. P. Booth, of the Montreal Locomotive Works; D. Butler, of the L'Air Liquide Society, and J. H. Rodgers, of the Canadian Machinery Co.

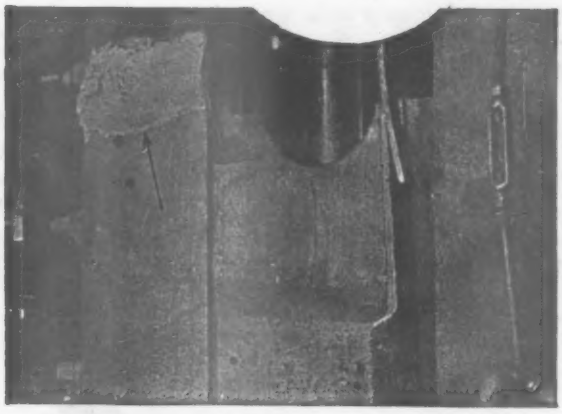
In opening the meeting Mr. McMillan, the chairman, who, with Mr. Barry had been present at the Toronto meeting a couple of weeks ago, outlined to those present the objects of the proposed society and the initial steps that had already been taken at the inauguration meeting. It was the opinion of those present that the science of efficient welding was not making the progress that it should, and that, in some instances great harm was being done and development retarded, due to the inefficiency of much work carried on by inexperienced operators, the results in such cases often giving a temporary "black eye" to the better progress of the welding art.

It was stated by Mr. Barry that the Government had the question of welding standardization under consideration, and it was only a question of time before they would be faced by certain regulations governing the practice of welding in general. It was therefore thought that a well-organized body of experienced welding men would be better able to cope with the situation and at the same time present a united front in protecting the interests of the craft, and likewise provide better facilities for discussing knowledge among its members.

While the proposed constitution, on the whole, was favorably received by the Montreal gathering, several clauses were the subject of criticism and discussion. One of these was that in regard to standardization in welding practice. As this was too wide a subject to be passed over lightly, and at such an early date in the activities of the society, it was deemed advisable to instruct the Montreal delegates attending the forthcoming meeting in Toronto, to obtain further enlightenment in regard to the question of "standardization." Mr. Dyer, of the Grand Trunk, remarked that the practice in railroad shops was, invariably, carried out under specific regulations, but that the system on one road differed from that on another, and sometimes to a great extent.

Exception was taken to the "head office shall be in Toronto." Due to the fact that the proposed constitution called for the election of officers by letter ballot, it was not clearly seen how an arbitrary ruling could be made in this connection, as it was possible that the election of officers might result in the president and secretary being elected from other points outside of Toronto. However, the Montreal interests are determined to work in harmony with these in Toronto and other centers, so that this point will receive full consideration at the next general meeting.

Still another feature was that respecting local branches. The constitution did not clearly define the organization details, and in view of the announcement of annual dues for the different grades of members, it was thought advisable to have a better understanding on this question, particularly on the point of financing of branch societies, before committing themselves. Before the meeting adjourned a short discussion took



Hammer column repaired by Thermit Welding

Don't Buy New Equipment!

Repair Your Broken Hammer and Forging Equipment

by

THERMIT WELDING

The illustration shows a Thermit weld made by the Canton Drop Forging & Manufacturing Company, Canton, O., on a 3000-lb. steam hammer column. The column is hollow steel casting, the thickness of the walls varying from 1½ in. to 2½ in.

The column having broken it was first repaired by drilling holes above and below the break, as shown in the illustration, and riveting large plates on the sides. This method, however, did not prove satisfactory. It was then decided to make a Thermit weld.

The hammer was dismantled and an opening of 2½ in. cut out with an oxy-acetylene torch, care being taken to clean off the slag from the section. It was then lined up, leaving a gap between the broken sections to allow for shrinkage.

The inside of the casting was rammed full of sand and a plate of sheet iron fastened around the opening to prevent the sand from falling out. After this operation was completed the plate was removed and the sand cut away to allow for wax pattern on inside, leaving the wax collar 6 in. wide on the outside. The mold box was then set up and the mold rammed, leaving a heating gate on both sides. Two preheating torches were applied on the broken sections for four hours, at the end of which period the Thermit reaction was started, using 450 lbs. of railroad Thermit. The weld was allowed to cool thoroughly before removing the mold box. The column was then machined, all of the collar on the inside being cut off to allow for the guide. This weld, according to latest reports, **was in service fifteen months under hard usage.**

This company has made several other Thermit welds, including crankshafts from 5 in. to 9½ in. diameter, hammer rams, one on a hammer anvil corner, others on the eccentric arm of a shear, and die blocks.

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place on some practical problems, and the interest shown indicated the advantages that would be derived by periodically meeting together and discussing one another's difficulties and experiences. Several present announced their intention of attending the meeting to be held in Toronto on February 26th.

HOW WELDING COSTS PYRAMID

By F. E. Seiler, Jr.

After many bitter experiences in errors of estimating costs of large welds, the welder develops an appreciation of the bewildering manner in which the cost of a weld rises with the increasing size of the broken part. More often, however, his

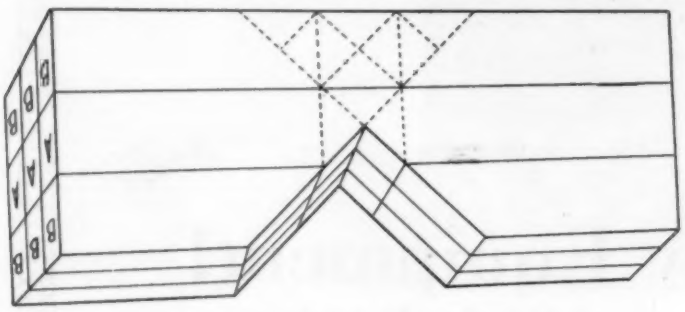


Fig. 1. Comparison of 1 "and 3" Bars.

appreciation is not all it should be, and he ascribes the terrific cost to some defect in his apparatus, gases, manner of preheating, or general procedure. The trouble lies in his failure to comprehend why the cost should be so much greater than that of a similar but smaller job. Granted that the welder is absolutely familiar with his problem, quite frequently he is at an absolute loss to clearly explain the apparently exorbitant charge to his indignant customer. The writer wishes to set forth a simple example that is quickly sketched on the shop floor and which has gained the confidence of many a customer and thereby allowed him the just, but apparently terrific, charge for the work.

What would you say would be a fair relative cost between welding a broken bar of 1-inch square steel bar and that of welding a broken bar of 3-inch square steel?

Do you think that the proportion of amounts of metal necessary to be added is a fair comparison on which to base costs?

Whereas much is to be considered on this subject it is the opinion of the writer that the cost per cubic inch of metal added to, let us say, a 6-inch shaft, will not be any less than the cost of adding the metal to a 2-inch shaft.

It is the opinion of the writer that as a basis for estimation the amount of metal necessary to be added is a fair comparison of probable costs.

And now for the question of the two broken square steel bars, the 1-inch square bar and the 3-inch square bar, regardless of what type of "V" or cut out is made for refilling, whether from only one side or from both sides excepting only that they be exactly similar in both cases the 3-inch bar will require twenty-seven times as much metal as the 1-inch bar to weld.

In the same manner a 3-inch shaft will require twenty-seven times as much metal to weld as a 1-inch shaft, a 5-inch shaft 125 times as much, and a 10-inch shaft 1,000 times as much.

The accompanying illustration (Fig. 1) shows a 3-inch square bar composed of nine 1-inch square bars, having been "Veed" out from both sides for welding. A right angle cut out has been made for simplicity and the lower half of weld is shown completed, but with small equal triangles sketched on the side to show exactly how much more metal is needed to join the "B" bars than the "A" bars.

By adding the equal triangle it is observed that four times as much metal is required to weld a "B" bar as is required to weld an "A" bar. Hence four times the six "B" bar or twenty-four plus the three "A" bars equal twenty-seven times as much metal for welding the 3-inch piece as is needed for an "A" bar or 1-inch piece.

A formula or rule to give the exact amount of metal needed to be replaced in a weld of any rectangular stock is as follows:

Multiply the width of the stock in inches by the thickness in inches by the greatest width of the "V" in inches and divide by two which will give the number of cubic inches to be replaced. As steel and cast iron weigh about a quarter of a pound to the cubic inch, divide again by four to get the number of pounds of filling rod required to make the weld.

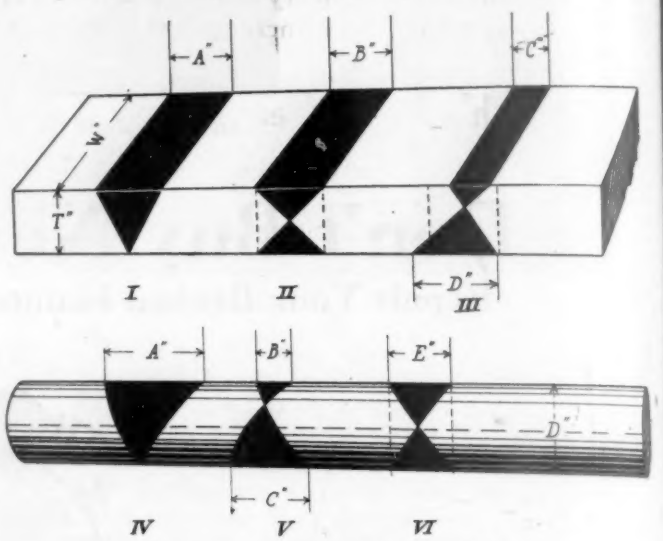


Fig. 2. How to Estimate Adding Material.

Where the material is round, such as shafting, multiply the diameter in inches by itself and then by the greatest width of the "V" in inches and you will have ten times the weight of metal needed and then by 40 per cent and you will have the number of cubic inches needed.

A rectangular bar and a round bar are shown in Fig. 2. The following formulas give the number of cubic inches of adding material needed for each weld:

For Weld I, $\frac{1}{2}(T \times W \times A)$
For Weld II, $\frac{1}{2}(T \times W \times B)$
For Weld III, $T \times W \times \frac{1}{4}(C+D)$
For Weld IV, $D \times D \times A \times .4$
For Weld V, $D \times D \times \frac{1}{2}(B+C) \times .4$
For Weld VI, $D \times D \times E \times .4$

A CORRECTION IN MR. SEDWICK'S PAPER

In T. D. Sedwick's paper, "Why Some Welds Fail," which appeared in the January issue of The Welding Engineer, there occurred a transposition of the illustrations that might be confusing to the reader who studied the photographs carefully. The illustration over Title No. 15 should be over Title No. 17; the one over Title No. 16 should be over Title No. 15; and the one over Title No. 17 should be over Title No. 16.

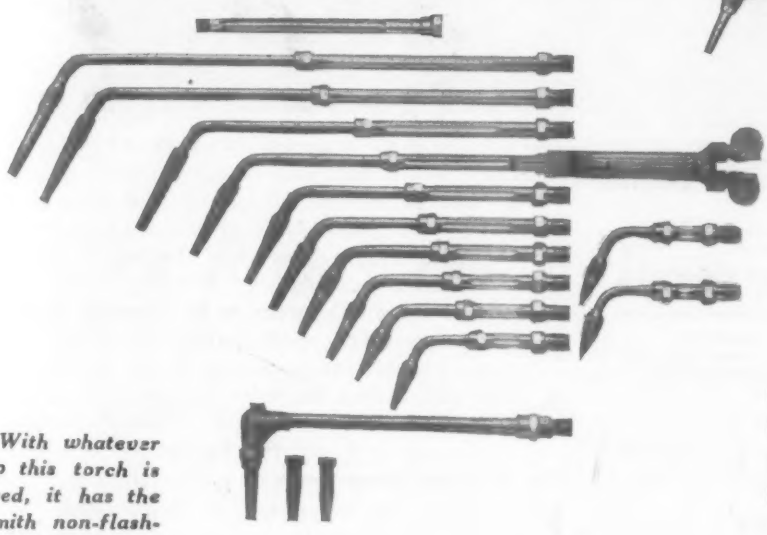
ADAMSON NOW MAKES TANKS

The Adamson Manufacturing Co., East Palestine, Ohio, have added a new department for manufacturing all kinds of storage, pneumatic and pressure tanks, welded pipe, battery casings, evaporators, condensors and a large line of arc-welded products.

The SMITH Line of Welding Torches

The success of the Smith torches is due to the fact that they possess distinctive features embodied in no other torches. They are also backed up by a reliable guarantee. In shops the country over they have enabled less skillful operators to do better work, and highly increased the abilities of skillful operators.

Smith's No. 6 Heavy Duty Torch



With whatever tip this torch is used, it has the Smith non-flash-back feature.

This torch is designed to meet the requirements of the most exacting work. It has a tip to fit any kind of work at hand. The torch has a fluted grip, is well-balanced, and is surprisingly light and easy to handle in spite of the heavy work which it is designed to do.

The welding tip may be replaced with a cutting tip and in a few seconds the welding torch is transformed into a cutting torch that will cut steel up to 6" thick.

Smith's No. 4 Pistol-Grip Welding Torch

Note the oxygenv alve right under your thumb, where you can adjust the flame as you work.

This economical, easily operated torch may be instantly changed into a cutting torch by changing tips. It stands up under severe use.

Smith's No. 9 Pistol-Grip Cutting Torch

This torch is hard to beat for cutting special shapes, risers on castings, sheets, steel work, etc. The jet lever is within easy finger reach, enabling the operator to do finest work without throwing the head out of line.

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Careful Buying and the Welding Industry

WILDCAT buying, demands for goods at any price, wasteful methods of manufacturing, had their day as the result of the war, and their day is over as the result of the end of the war. Millions of men are returned to their normal occupations and the products of American industry are being carefully used instead of wasted and destroyed. Things last longer and there is more labor available, so naturally enough buying is not done so frantically and prices are forced to a more reasonable level. It is a change of condition that should be good for the welding industry. The factory manager will not throw away a broken casting if a repair can be made at a small fraction of the cost of replacing it with a new one. Nor will he hesitate to use welding processes if they promise a reduction in his manufacturing costs. Some vigorous canvassing at this time will increase the business of any good welding shop. Look about and you will see that your selling campaign is ably seconded by the advertising campaigns of the large manufacturers of welding apparatus and supplies. Business papers circulating among the trades that have the most use for welding, such as the machinery, sheet metal, mechanical, railroad, shipbuilding and automobile trades, publish articles on welding with increasing frequency, and carry a considerable volume of advertising devoted to welding apparatus. (A paper on the subject of testing welds, from the proceedings of the American Welding Society, was published in about twenty influential business papers in America this winter, and reproduced in several European publications.) And recently full-page advertisements of an educational nature have begun to appear in some of the largest American magazines of national circulation. Welding is such a young industry that the public needs to be educated in this manner, and as its possibilities become better known it will continue to grow. The immediate present is the time for the welder to study and perfect his work, and improve today's opportunity to demonstrate the fact that *welding* is *economy*.

The Welding Encyclopedia

IN compiling the first edition of The Welding Encyclopedia the aim of the publishers has been to put in the hands of every welder a book that he can rely upon for complete information relating to the sort of welding that he is doing, and put at his disposal along with it the same information about what the other fellow is doing. The text has been constructed in a thoroughly practical manner, eliminating theoretical comparisons and sticking close the helpful suggestions. Welding has only recently became a subject for discussion in business and technical papers, and the current literature on the subject is full of words and terms that are not completely understood, so the really careful reader needs a dependable reference work that is up to date. And it is particularly important that the apprentice or student welder have an authentic text at hand. Lectures are given only a fraction of the time in welding schools and the lectures are easily forgotten; even the essential principles of welding can soon become obscure if not preserved in black and white. Furthermore, the beginner usually is familiar with only one type of equipment or apparatus. The Welding Encyclopedia will quickly familiarize him with all the standard, reliable brands of apparatus and supplies on the market. To the experienced welder it supplies a big fund of long-needed welding "dope" in convenient, useful form, practical discussions for the practical welder. It is a book that the trade will appreciate.

The Safety Factor

LAST month *The Welding Engineer* published a paper by Mr. T. D. Sedwick on the subject of welding failures. An important point mentioned in that paper is a point with which

Quick repairs to the smashed bow of one of the United States Emergency Ship Corporation's vessels

The Rivets Have Been Burned Out

CONSIDER the ease with which Oxy-acetylene accomplishes the most trying operation that comes to any ship-yard—repair work on framing and plating.

Compare this modern method of cutting out rivets, of severing frames, of sundering plating to the obsolete method of the cold chisel, drill and hack-saw. It's like comparing the craft of Columbus to the enormous ships of to-day.

In the ship-yards, in fact wherever welding and cutting is done

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The Universal Gas With The Universal Service

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And advantageous as this ease of cutting out damaged parts with the oxy-acetylene blow-pipe is, this splendid tool has also the power to join the metals together again, and the joining will have all the qualities of the metals joined.

There are so many reasons why Prest-O-Lite is especially adapted for the particular work of ship-yards that we invite you to ask us all of them.

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the layman is apt to be unfamiliar—the factor of safety. The engineer always consider this factor carefully. It is not enough that a structure is built strong enough to support or resist the maximum load or stress to which it will be subjected. Several times the required strength must be secured in order to allow for gradual weakening of the members or possible underestimating of their original capacity. If a very long period of service is expected the factor of safety is increased. The theory of this is perfectly sound, because it is more economical to build right the first time than to make repairs when breaks occur. Yet the factor of safety is frequently overlooked in making repairs. "If it's strong enough to do the work, it's strong enough," is a very indifferent motto, and the following of it should be discouraged. The aim in welding ought to be to secure as much of the original strength as possible and preserve the safety factor.

COMPRESSED GAS MANUFACTURERS' ANNUAL MEETING

The Compressed Gas Manufacturers' Association held its eighth annual meeting on Monday, January 17th, at the Hotel Astor, New York. The meeting was the best of its kind thus far held by the association.

The reports of the different committees were read to the members and will be printed on the annual report of the association's work which is sent to members only. The matters discussed were of very great interest and importance to compressed gas manufacturers and were well received.

In the evening of January 17th, the eighth annual dinner was held at the Hotel Astor and was attended by between 225 and 250 persons. An excellent menu and entertainment was provided and the crowd joined in singing many of the old-time songs. The new president, Mr. A. R. Brunker, of the Liquid Carbonic Co., was toastmaster and the retiring president, Dr. Hugo Lieber—who has held this office for the eight years of the association's existence—was presented with a beautiful silver loving cup and a beautifully engrossed testimonial. The testimonial was presented by Major J. C. Minor, one of the active members of the association since its organization. Dr. Lieber responded in excellent manner.

Colonel Dunn, of the Bureau of Explosives, gave a short, but very interesting address.

Mr. A. Cressy Morrison, who is now first vice-president, spoke very entertainingly on the great importance of the compressed gas industries and the great part all had played in their development.

The Compressed Gas Manufacturers' Association consists of manufacturers of oxygen, hydrogen, acetylene, ammonia, carbonic gas, chlorine, sulphur dioxid, carbo hydrogen, pintsch and other gases and its membership includes every such manufacturer in Canada, some in Cuba and Mexico and with very few exceptions all those in the United States.

On Tuesday, January 18th, a conference was held between various of the Technical Committees and the members of the association and the entire day was spent in discussing technical matters concerning specifications for cylinders, regulations, etc. This meeting was of great importance and highly educational. The proceedings of this meeting are also being put into printed form and will be distributed to all members.

The Compressed Gas Manufacturers' Association has also an associate membership consisting of manufacturers of appliances used in connection with the compressed gases and in the manufacture of the gases. The close co-operation between the associate members and the compressed gas manufacturers is of great benefit to both parties and is responsible for the great progress being made in the compressed gas field.

Compressed Gas Manufacturers' Association Dinner.

AT THE PINNACLE

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"BEST BY TEST"

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SOME TERRITORY STILL OPEN FOR LIVE AGENTS WHO CAN PRODUCE RESULTS.

INTERESTING HYDRAULIC ELEVATOR PUMP REPAIR

One of the elevators of a fourteen-story building in New York's financial district was recently put out of commission by the breaking of a hydraulic pump casting. On examination it was found that the metal casing was badly cracked in four places (two on either side), the breaks penetrating clear through the shell, which was 2½ inches thick, and each crack extending a distance of 5 or 6 inches.

The damage was so serious that it was thought an entirely new casting would be required. When it was found, however, that replacement would cost $1,800, and that it could not be effected without serious delay, an oxy-acetylene welding firm was consulted to ascertain if the damaged parts could be repaired. On reporting favorably the welders were directed to proceed with the job, and the following day the elevator was returned to service.

A specially interesting feature of the job, which was otherwise typical of repairs that are being made every day by the oxy-acetylene process, was the problem of ventilation. The repair was made in the pump room, and, of course, was one requiring thorough preheating. This operation was complicated by the fact that the pump occupies a space in the basement under the elevator shaft, where, if special ventilation were not provided, the gases from the charcoal would seriously affect the welder. This difficulty was surmounted by connecting the building's ventilating apparatus in a manner to draw off the fumes. Another difficult situation confronting the operator was the cramped space in which the work had be be carried out, but this is an obstacle with which welders frequently have to contend.

Welds in Corners of Open Space. The White Streaks Were Caused by Paint.

The actual time, including preheating and welding, occupied sixteen hours, two welders working in relay. In the preheating four and one-half bags of charcoal was burned and the gas consumption for welding was 360 cubic feet of oxygen and 300 cubic feet of acetylene. Approximately thirty pounds of welding rods were used in filling in and building up the welds. The casting, after repair, was subjected to 160 pounds per square inch working pressure, and is today as good as new. The expense of the repair was but a small fraction of the sum a new casting would have cost, and the saving in time was the difference between hours and several weeks. The repair was made by the Bournonville Welding Co.

NOVEL USE FOR OXY-ACETYLENE

From the Engels Copper Mining Co., Engelmine, Cal., comes the information that this company uses the oxy-acetylene cutting blow pipe for removing "hammers" and other "tramp iron" from ore crushers. "We have found this the quickest and easiest, as well as the cheapest way to cut the hammers out of our gyratory crushers," the company writes.

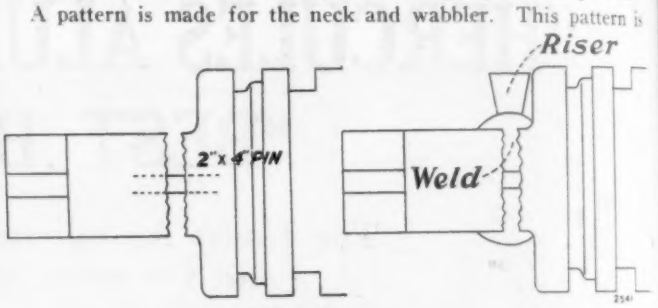
Practically every mine, large and small, has as a part of its equipment a coarse crusher of some sort. Run-of-mine ore is fed to these crushers, and, even with the utmost precaution, hammer heads and other pieces of metal become mixed with the ore and get into the crushers. Where no preventative devices are used, foreign matter of this kind gets into the crushers quite frequently, and if not removed may damage or seriously interfere with the operation of the equipment.

The experience of the Engels Copper Mining Co. suggests a fast, cheap and effective way of handling a difficulty that has been a source of more or less constant trouble in mining plants everywhere.

WELDING ROLL NECKS

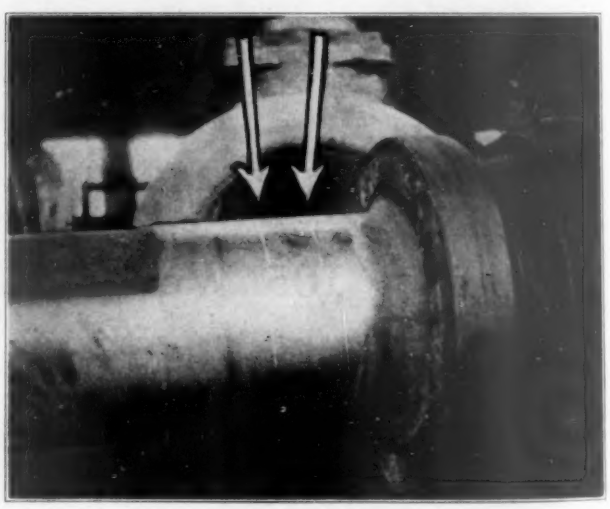
The illustrations show a successful method used by Charles Fosberg, Sault Ste. Marie, Ont., for welding a great many rolls.

A pattern is made for the neck and wabbler. This pattern is



Roll Neck Pattern.

used for making a casting for this part. The casting is then lined up with the broken roll without machining and the two sections welded together as shown in the sketch. This makes an entirely new roll from a broken one and works finely whether the weld is large or small. The new end casting is not machined until after the weld is made, owing to the fact that certain strains are set up in cooling which are likely to distort and throw the billet out of alignment.



Welded Roll Neck.

As the piece is cast in steel, Railroad Thermit, which is thermit with a mixture of iron oxide and aluminum, plus a mixture of 1 per cent pure manganese, ⅝ per cent nickel shot and 15 per cent mild steel punchings, is used, for all cast iron or steel rolls.

In certain cases only the wabblers are broken in which instances just a new top is welded on.

"U. S." ACETYLENE GENERATORS

SIMPLE—EFFICIENT—AUTOMATIC

LOW PRICED

Makers of famous "U. S." Welding & Cutting Apparatus

UNITED STATES WELDING CO., Inc.

Distributors Wanted—*Write for Particulars*

ADVICE TO YOUNG WELDERS

Editor: I think the best advice you can give the man who is just starting to learn the welding trade is to get in touch with a welder who knows his work and who is making welds that hold, and let him teach the young man how to do the work properly. I have seen a great deal of welding done by beginners that does not hold, and I know it would pay them

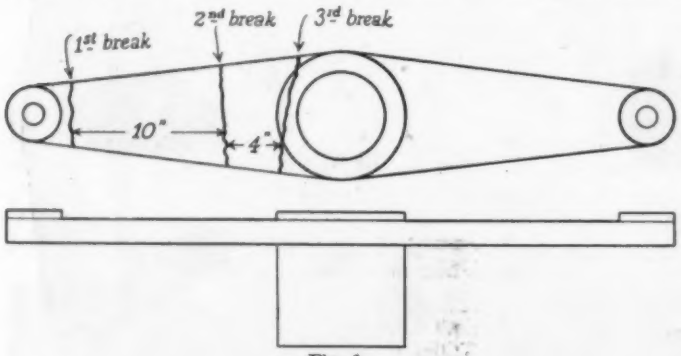


Fig. 1.

to get instructions and suggestions from a man who is a real welder.

Just a few days ago I undertood a job that another welder had tried without success. Three teeth were broken out of a big gear wheel belonging to an old well digging machine. One man had welded new teeth on the wheel and they broke off as soon as the wheel was put into service. Several other

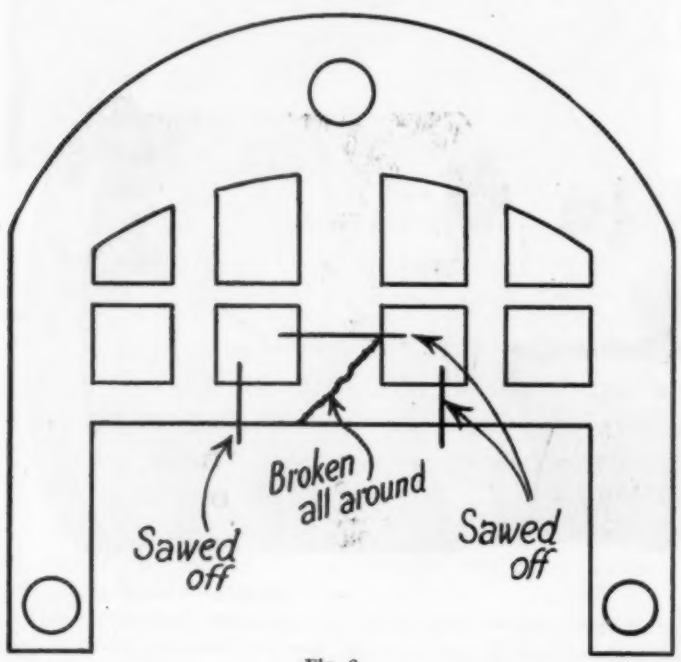


Fig. 2.

parts of this machine had been welded so poorly that the welds broke so the manager was getting the impression that welding was a fake, and had just about decided to shut down completely and wait for a new gear to be shipped. A friend of mine had just started to work on this machine, and he advised the boss to let me try to weld it. The job was not at all difficult and the machine has been running ever since.

Fig. 1 shows a clutch arm of a big tractor which I have welded three times. It has never broken in the welds. The cause of the break is really faulty construction, which allowed a side strain on the arm greater than the metal would stand. Fig. 2 is a cast iron section of a heating plant which I welded two years ago. All the welds are still holding O. K. It was necessary to cut this section in three places as shown. Fig. 3 is a furnace repair job that took about ten hours, as it had to be preheated to a red heat and welded while red. This job was done three months ago and is giving perfect service.

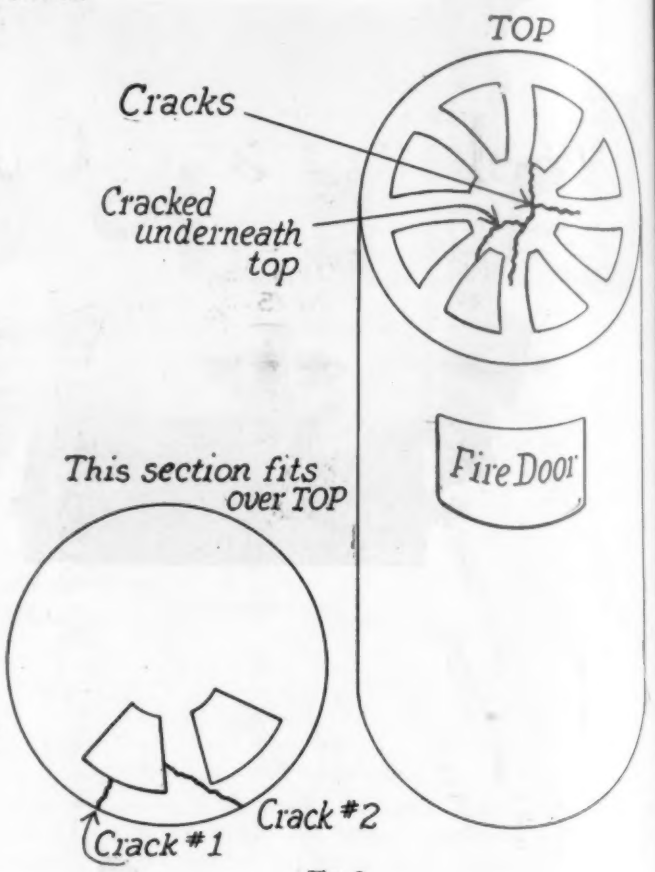


Fig. 3.

These jobs are not complicated to any great extent, but a man should not attempt even a simple welding job unless he understands how to do it and how much it must stand after it is completed.

Yours truly,

Harry Witt.

WELDER USES BILLBOARDS

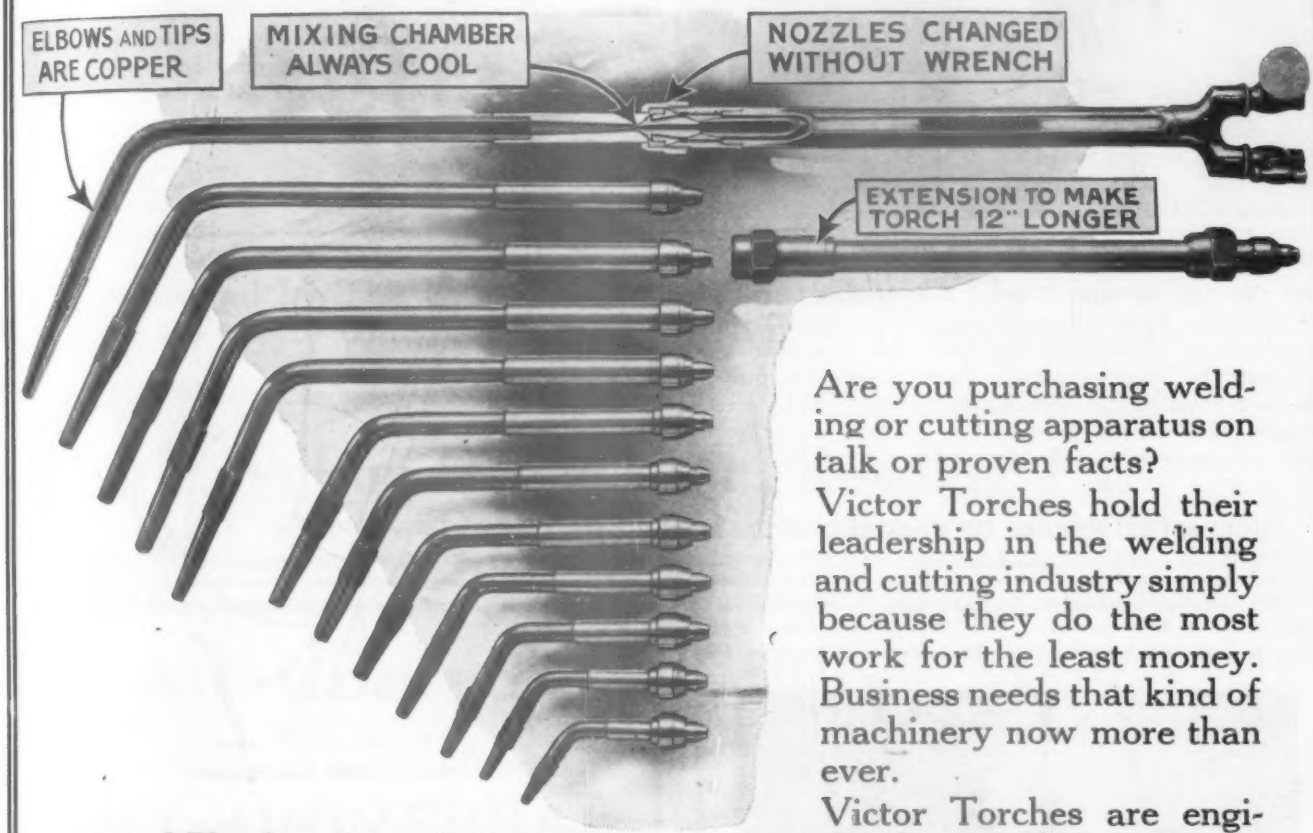
Waiting for business to come to the shop is as out of date as using stone slabs for correspondence. The modern welder lets everyone know that he is in the business and that he wants orders. An unusually striking example of advertising for the

A Welder's Billboard.

welding shop is the billboard shown here, erected by the Master Welding & Cutting Corporation, of Detroit, Mich. This shop does a large variety of welding and has considerably increased its trade in the vicinity of the city by live methods of getting new customers.

VICTOR
TRADE MARK

Welding and Cutting Apparatus


ELBOWS AND TIPS ARE COPPER
MIXING CHAMBER ALWAYS COOL
NOZZLES CHANGED WITHOUT WRENCH
EXTENSION TO MAKE TORCH 12" LONGER

Are you purchasing welding or cutting apparatus on talk or proven facts?

Victor Torches hold their leadership in the welding and cutting industry simply because they do the most work for the least money. Business needs that kind of machinery now more than ever.

Victor Torches are engineered Torches from their very beginning, and today stand alone in performance of work, because of their low cost of operation. They are speedier on account of the construction of the mixing chamber. The latest improvement makes the Victor the only non-back firing torch operated under any condition or pressures of gases.

The Victor is the first torch built in America having the copper elbow nozzle and tip with the mixing chamber far removed from the point of combustion. Other features embodied in the construction of Victor torches make for their inimitable success.

Send for Folder "Reasons Why"

DISTRIBUTORS WANTED—Valuable territory open for reputable concerns who desire to handle the best apparatus, and build up a permanent business. Write for terms.

Victor Oxy-Acetylene Equipment Company

10 North Jefferson Street
Chicago, Ill.

884-886 Folsom Street
San Francisco, Cal.

DUNHAM ON EUROPEAN TOUR.

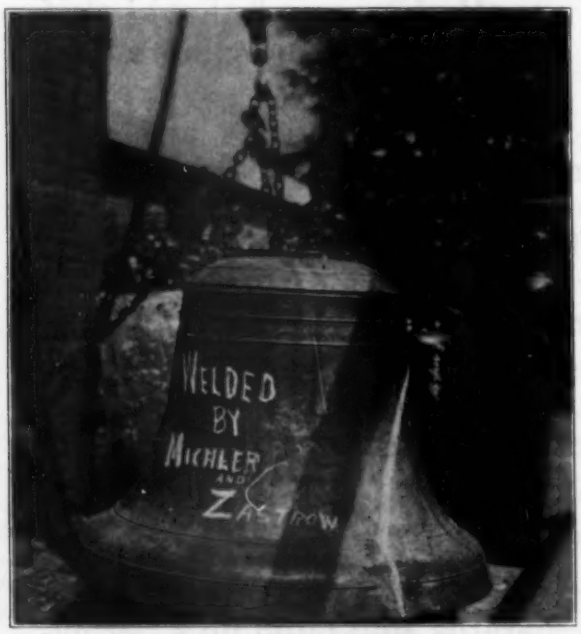
M. Keith Dunham, accompanied by Mrs. Dunham, sailed for Europe on Tuesday, February 1st, on a business and pleasure trip that will probably extend through the late summer. Mr. Dunham is well known to the trade as the inventor of the Rego torch and the author of "Automobile Welding

Mr. and Mrs. M. Keith Dunham.

With the Oxy-Acetylene Flame," and through his association with the Bastian-Blessing Co., of Chicago. While in Europe he will probably devote some time to arranging for marketing the Rego torch, the patents of which he owns, in some of the continental centers. Mr. Dunham can be reached through the American Express Co., London, where he has made arrangements for forwarding correspondence.

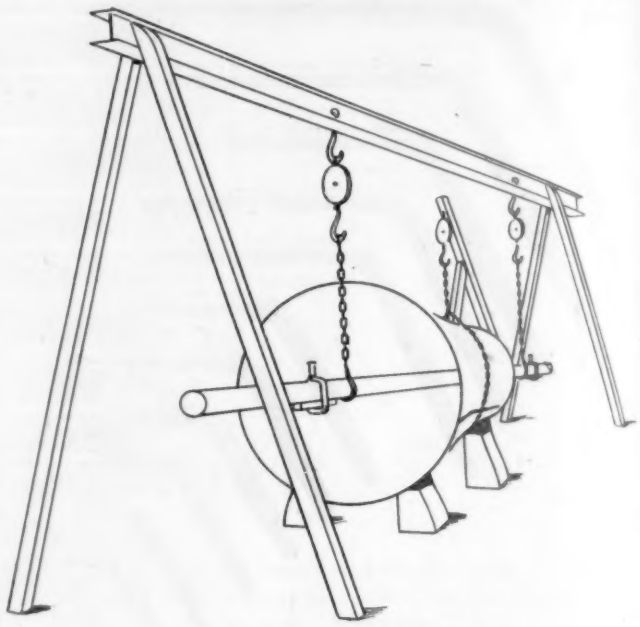
SUCCESSFUL REPAIR OF CRACKED BELL

Editor: A short time ago we welded a cracked church bell weighing about 2,800 pounds. The length of the crack was 36 inches and the thickest part of the bell was 5 inches. First



Bell Repaired Has Original Tone.

we made a basket of heavy screen to hold charcoal and preheated the bell for three hours. The welding was started before the bell was hot enough to melt lead, and the first part of the weld extended about 12 inches from the end of the crack. Then the bell was turned and the opposite side brought down 24 inches and turned again, and so on. The turning of the bell was done with a chain hoist. Three strands of chain were wrapped through the top and lower openings of the bell, then holding two strands and leaving the third one loose permited the bell to slide down easily for a new hold. To hold the bell at the proper level where the welding was being done, a bar was put through both openings of the bell, to which another hoist was attached. Two leather dogs were clamped to the bar to prevent the chains for slipping. When welding the inside of the bell, the basket of charcoal was taken out and fresh coal added so that when welding was started again there was a good hot fire ready to set inside the bell again. During preheating the basket was covered with a large sheet iron having an opening so that charcoal could be added easily. When chipping out the crack, as many chips as possible were saved and melted into the weld, especially on the surface, giving the bell its orginal color when finished. It was difficult to find the extreme end of the crack even with



How the Bell Was Handled.

the help of a magnifying glass. We drilled three holes to find it, but found when we began chipping that the end of the crack had not been reached, so we drilled a fourth hole part way through and poured coal oil in it, and this soon located the end for us. The adding material was manganese bronze filler rod and chips from the bell. The bell foundry asked $500 for recasting the bell, and our price for repairing it was $150. The bell is now in service and the people of the congregation say that it has its original tone.

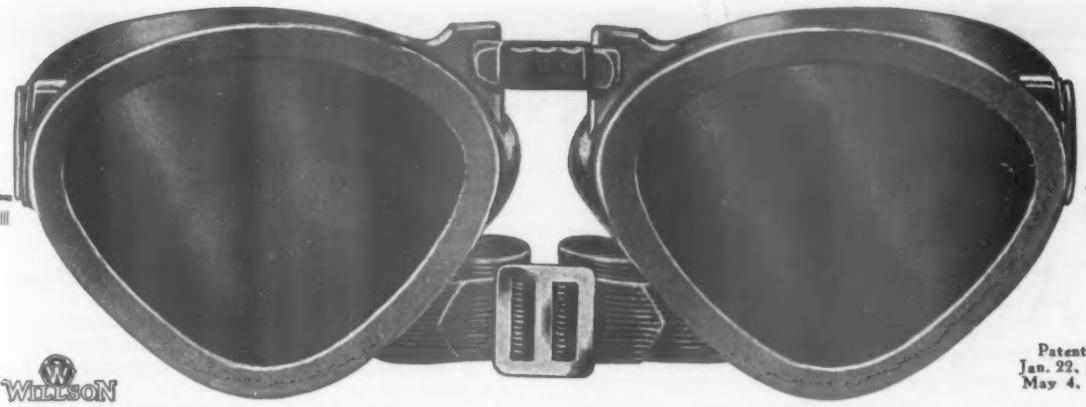
Yours truly,

O. F. Michler.

WILLIAMS ANNOUNCING NEW ELECTRODE HOLDER

Roy O. Williams, of Columbus, Ohio, is marketing a new air-cooled electrode holder, the "Universal," for electric arc welders. The holder is twelve inches long and weighs one and one-quarter pounds, and is provided with a trigger release that enables the operator to drop the waste piece of the electrode in an instant. The device is constructed of wood fibre and manganese bronze.

Has any welder a practical method to suggest for welding cast iron lugs to pressed steel strips?



Patented
Jan. 22, 1918
May 4, 1920

Better Welding

—and good, steady production often are merely a matter of eye-comfort to the welder. The Willson Triangular Welding Goggle, Style L1, keeps out all sparks and permits free ventilation. Equipped with latest features, and all parts can be replaced without a tool.

Approved by The Underwriters' Laboratories. The lenses meet all safety code requirements by Bureau of Standards test.

Price $300.00 per hundred, f. o. b. factory. Ask for trial goggle on your company letterhead.

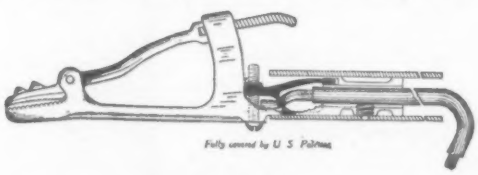
Willson Goggles Inc., Reading, Pa.

The world's largest factory making goggles and respirators exclusively.

Air-Cooled

Electrode Holder That Grips At Any Angle

THE UNIVERSAL



Fully covered by U. S. Patents

Positive grip through both jaws, universal grip between jaws. Length 12 inches. Weight 1¼ lbs. Air cooled handle.

Constructed of manganese bronze and wood fibre. Hand does not come in contact with metal while welding.

A saving of 75% of time by the trigger release of hot waste material.

In feeding or installing new electrode, operator's hand never comes in contact with hot metal.

Price $6.00

For Sale by All Leading Jobbers

MANUFACTURED BY

ROY O. WILLIAMS

946 Livingston Ave. Columbus, Ohio

DON'T LOSE TIME

When Dressing the Weld

Because of **HARD SPOTS**

Make It Easy to File or Machine

Please Your Customers, Satisfy Yourself

USE

SOFT Y TRADE MARK WELD

FLUXES

For Cast Iron, Brass, Bronze, Malleable Iron and Steel.

Soft-Y-Weld Will Cleanse the Metal, Prevent Blowholes, Make a Strong Weld and Leave It **SOFT**

TRY IT

Write for Price and Free Sample

The Blackrock Mineral Company

DENVER, COLORADO

ADVERTISING

By DR. FRANK CRANE

(Copyright by Frank Crane)

ADVERTISING is the greatest business in the world. That is not because it enables business people to sell more goods, not because it is a way to make great profits. Nothing can be really great for any purely dollars-and-cents reason.

It is because, in advertising, business becomes vocal. When, in the course of evolution, the animal acquired speech and became able to utter himself, he had made the longest stride in development. He had stepped from brute to man.

The human soul dates back to the first word. "In the beginning was the Word."

Advertisement is the utterance of human energy. Craftmanship is good, and industry, and organization, and business ability; but they are dumb giants until they find speech—dumb and dangerous.

Business, including manufacturing, farming, transportation, and selling, is to the new world what fighting was to the old. The old world organized only to kill, and its genius was displayed by great generals. Its heroes were the mighty killers. To them it set up its statues.

The new world, typified by, led by America, is organized to serve, to make human life richer, deeper, stronger, more complex and heterogeneous.

And business is simply service. Business comes to itself, attains maturity and full self-expression only through advertising.

Advertising is the breath of life breathed into the nostrils of business, by which it becomes a living soul.

Thus advertising not only enlarges business; it radically changes the nature of business.

By it business passes from bureaucracy and autocracy into democracy. It takes the whole people into its growth. It enters the veins of the commonwealth. It becomes a function of communal life.

Without advertising comes decay and death.

Nations need advertising. If they would advertise they would prevent war. War is the self-expression of dumb brute force. Advertising is the self-expression of intelligent strength that knows how to speak.

It is the something plus in advertising that is significant. It is this something plus that makes advertising to business what art is to handiwork, what music is to feeling, what language is to the soul.

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Each has subscribed to and is maintaining the highest standards of practice in their editorial and advertising service

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Automobile Journal
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Motor Age
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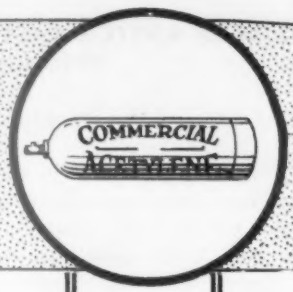
THE ASSOCIATED BUSINESS PAPERS, INCORPORATED

HEADQUARTERS - - - 220 WEST 42nd STREET - - - NEW YORK

Commercial Acetylene



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S E R V I C E ▫

IF you buy acetylene you should become familiar with the COMMERCIAL plan.

Buying the *Commercial* way means that you buy gas only—we loan you the cylinders. **You USE what's inside the cylinders, and that's all you pay for.** You can get your money's worth, too, for *Commercial* acetylene is uniformly pure—it makes sound welds. *Commercial* engineers and *Commercial* plants and warehouses are at your service in every section of the country. Submit your welding requirements to our nearest office.

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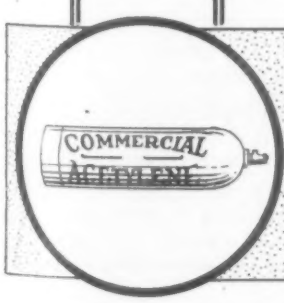
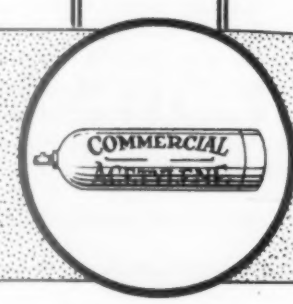


Commercial Acetylene



BROKEN SWITCH CASTING RECLAIMED BY ELECTRIC ARC WELDING

By Andrew McGregor*

EVEN in these days of surprising achievements, we at times find some unusual accomplishment which attracts and holds our interest. Such was the case when a repair made by the New York Railways was brought to the writer's attention.

A right hand switch casting which had seen service on their

Repaired Switch Casting.

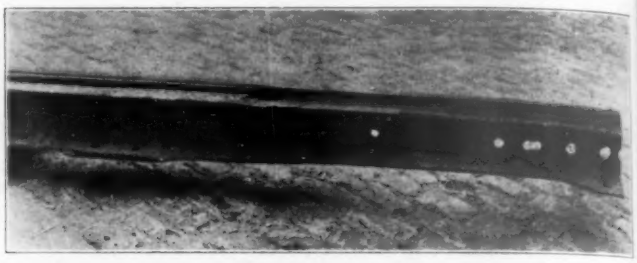
system as a one-way switch, at 59th Street and 6th Avenue, for a number of years, finally became so badly worn and broken that it had to be removed. It was found that at a place about half the length of the switch point, where the car wheel started to bridge the switch tongue and the running rail, to the end of the casting, the running rail was worn to a maximum depth of approximately 7/8 inch. At the end of the casting the splice plates were broken, and the rail had been so weakened by wear that the head of the running rail was broken off for a distance of 27 inches from the end. A somewhat similar condition was found at the heel end of the casting. Not

Heel End of Casting.

only was the head of the running rail worn and a section 20 inches long broken off, but the gauge line of the running rail was also worn away for approximately three-fourths of an inch.

A short time ago this casting would have been scrapped. In fact, some of the less progressive roads still scrap such sections, but the Maintenance of Way Department of the New York Railways was equal to the occasion. They removed the section to their yard and using an electric arc welding machine they not only reclaimed the casting, making it practically as good as new and destined still to serve its purpose for a number of years, but also accomplished it at a saving of approximately $350.00.

It was interesting to see the ingenious manner in which the repair was made. At both ends where the running rail was broken a steel plate 1 inch by 5 inches was arc welded solid to the web and another piece of steel 1 inch by 2 inches was arc welded to the top edge of the plate to form the head of the rail. The plates were prepared long enough so that they extended approximately 15 inches beyond the end of the rail,



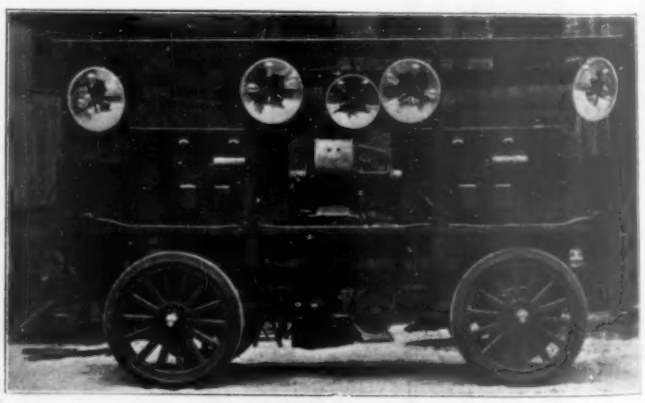
Toe End of Casting.

thereby forming a splice plate on one side of the web at each end.

The top and inside edges of the plates were built up with steel by means of the electric arc, until the head of the rail was brought back to normal. For a depth of approximately 1/8 inch from the top a layer of special hard-grade steel was used.

Where the rail was worn, but not broken, the surface was built up with mild and hard steel, until, after grinding, all sections were brought back to their original dimensions. No attempt was made to weld the switch tongue. It was simply replaced with a new one. The switch casting was made by the Lorain Steel Co. The center section of the rail is of manganese steel and is keyed into the steel casting.

The writer is informed that this is only one of a number of cases where the use of electric arc welding has saved the



Portable Welding Shop.

company considerable money and lengthened the life of their equipment. In fact, the machine has made itself indispensable.

At some crossings they have replaced worn and broken manganese hard centers, with special forged tool steel plates, arc welding the plates in place. At another location where a long section of the rail had been broken out, and where the expense of removing the pavement to replace the rail, would make its replacement costly, it was found that with the aid of the arc they were able to graft a new section of rail in place, without disturbing the pavement to any great extent, and consequently added another achievement to their credit.

Electric arc welding means a saving to the railroads of thou-

Chief Engineer, Arc Welding Machine Co., Inc., New York City.

USL
ELECTRIC ARC WELDER

ELECTRIC ARC WELDERS

The ease with which the USL Arc Welder maintains a steady arc and a persistent flow of metal at the arc, enables the welding operator to accomplish the maximum amount of efficient welding work in a day.

A recent test to determine the actual amount of metal deposited by the USL Arc Welder at 200 amperes in a single hour shows—

Twenty-four ¼-inch electrodes were required to keep the operator at work for one hour.

Weight of electrodes	**4.8**	**pounds**
Weight of unused wire stubs	**.75**	**pounds**
Metal melted in arc	**4.05**	**pounds**
Equivalent electrode length	**24**	**feet**
Weight of steel plates—		
After welding	**12.625**	**pounds**
Before welding	**9.125**	**pounds**
ACTUAL METAL DEPOSITED	**3.5**	**POUNDS**

The USL Arc Welder embodies new and exclusive design and operating features. It is self-exciting, inherently regulated and fool-proof: it does just one thing—electric arc welding—does it to better advantage and at a reduction in operation cost from 67 to 90% in comparison with gas welding.

May we send you our bulletin 700 ?

U. S. LIGHT & HEAT CORPORATION

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Try This New Goggle

Made of aluminum, very light weight, but strong. Fitted with our scientific Weldoglas lenses it makes an excellent welding goggle.

Padded with insulation impervious to moisture, will not sweat, gum or stick.

No. 304—Aluminum Welding Goggle....$16.90 per 10
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Safety Goggle Manufacturers and Distributors

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Weldbest Asbestos Welding Paper

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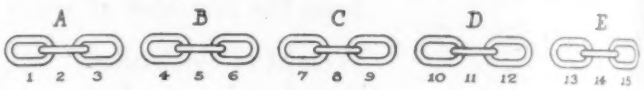
A SHORT CUT IN CHAIN WELDING

Editor: Below is an interesting little puzzle on welding a broken chain. It is not original with me, but some of your readers may like to see it.

We have fifteen links of chain in groups of three links each (A, B, C, D and E). These five pieces we want to join together into one continuous piece of fifteen links. The cutting and welding of this large chain is an expensive operation and



must be done in the fewest possible number of operations. How many cuts and welds are necessary?

One would suppose four, but here is the answer:

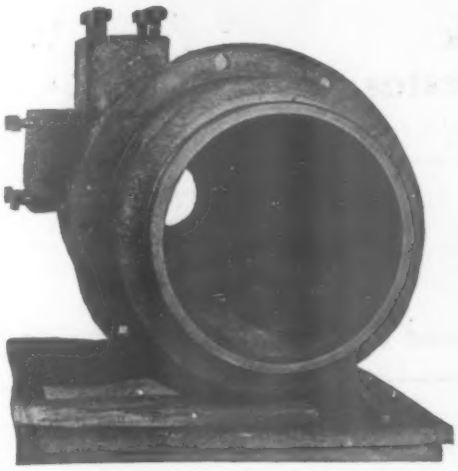
Cut link No. 1, No. 2 and No. 3. Weld link No. 1 into link No. 6 and No. 7. Weld link No. 2 into links No. 9 and No. 10. Weld link No. 3 into links No. 12 and No. 13. Therefore only three cuts and three welds are necessary.

A. E. De Burn.

A GAS WELDED TANK

In the accompanying illustration is shown a tank welded by the oxy-acetylene process in the shop of the Chicago Machine & Washer Co., 2625 West Fifteenth Street, Chicago. James

Zajicek, who did the job, gives the dimensions of the tank as 11 feet by 5 feet by 4 feet, and the weight, 1,900 pounds. It is constructed of ⅜-inch plate throughout. As the picture shows, it was a neat, solid job, free from buckling.



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EXPANSION AND CONTRACTION—Warping, distortion, buckling and cracks will inevitably occur in welding unless expansion and contraction are allowed for. It is useless to attempt to arrest or control the expansion by force.—Acetylene and Welding Journal, January.

METAL CUTTING PROPERTIES OF GASES, by Pierre E. Haynes.—Elements affecting the gases used for both welding and cutting are discussed. Essentials of the flame-cutting process. Regulation of pressure and jet velocity of oxygen. Effect of heating oxygen. Efficiency of cutting flame. The author is an advocate of liquid air oxygen.—The Boilermaker, January.

ARC WELDED SHIPS, by O. H. Escholz.—Some of the problems involved in the application of arc welding to shipyard work are outlined briefly in this article. Advantages of arc welding. Feeding materials and assembling methods. Cost of welding.—Marine Engineering, January.

LITTLE IDEAS FOR BIG WELDERS, by David Baxter.—Helpful suggestions for economy and efficiency in the welding shop. The "Hot Finishing" process. Aligning castings. Making a stationary tool of a portable grinder. Utilizing waste space. A sample of metal penmanship.—Acetylene Journal, January.

PROGRESS OF WELDING IN THE SHIPYARDS, by William T. Bonner.—Advantage of using higher amperage. Electrically welded seams for plating. Education of welders. The American Welding Society. Attitude of the classification societies. Welding approved by Steamboat Inspection Service. Attitude of Shipbuilders. Typical examples for welding. Specimen records of welding work. Miscellaneous suggestions for welding. —Marine Engineering, January.

ELECTRIC SEAM WELDING MACHINES, by Dr. Alfred Gradenwitz.—Types for circular and longitudinal seams. Intermittent action prevents oxidation at welding point. Welding bottoms in iron drums and small containers. The machinery described is of German manufacture.—American Machinist, January 27.

WELDING FAULTS, by Marcel Piette.—The causes and remedies of the three most common faults of welds, lack of penetration, adhesion and scarfed welds. An important observation made in this article is that adhesion in the chamfer is caused by holding the torch tip inclined so much that a quantity of the molten metal is driven ahead of the pool and against the cooler faces of the chamber.—Revue de la Soudure Autogene, December.

SETTING UP WORK—CONTRACTION, by W. B. Purdue.—If the welder does not allow for shrinkage, the work will either break or become distorted. The beginner should practice on thin pieces until he can reduce the initial angle of separation to a minimum.—Canadian Welding Journal, January.

REACTIONS—Quarterly house-organ of the Metal and Thermit Corporation. In the first quarterly issue, 1921: A Rock Crusher Repair; Welding Roll Necks; A Repair With Riser Bases at Different Levels; Welding Double Track Frogs; Locomotive Welding.

WELDING A LARGE STEEL CASTING WITH THE OXY-ACETYLENE BLOWPIPE, by David Baxter.—The metal was cut away from the crack, with the torch, the full thickness of the casting, then the casting was preheated all over with a charcoal fire. Little attention was paid to the surface part of the weld while it was being made. This was refinished after the groove was filled. Especial care was taken to keep the piece hot and keep the torch flame working constantly.—American Blacksmith, January.

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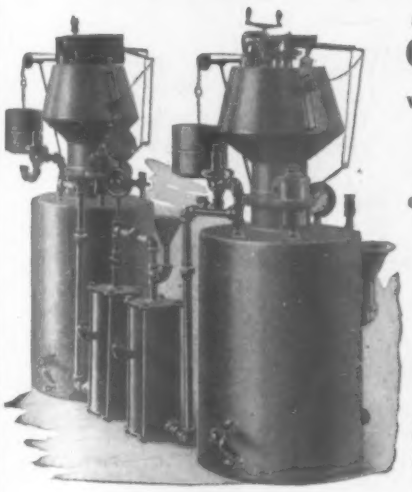

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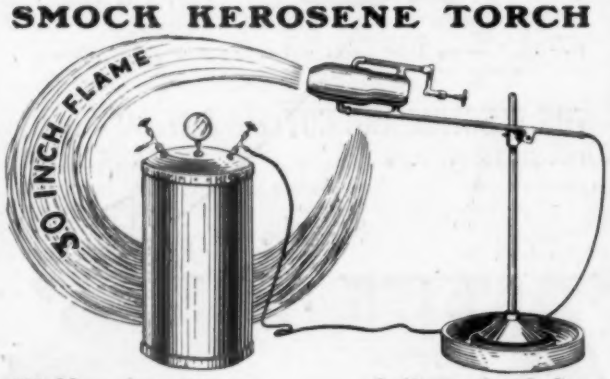

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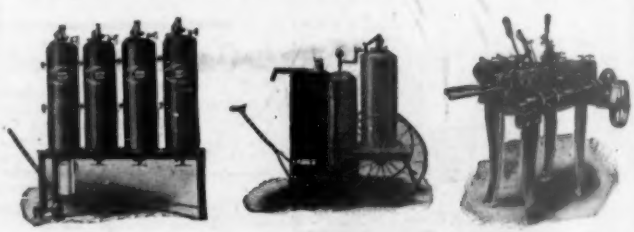

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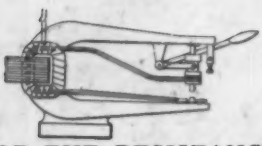

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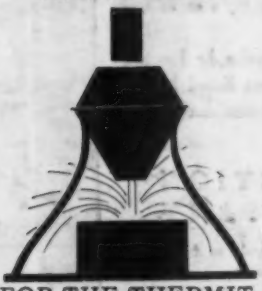

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